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Lighting Facts to Ponder Over

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Immense loss chargeable to poor illumination—The fundamental principles of good lighting—Perception, discrimination, sustained vision and what the foot-candle meter will show

A FEW months ago one of the leading electrical journals published an editorial entitled, "Poor Lighting, The Boll-Weevil of Industry." In this rather striking metaphor the writer brought out the fact that the annual loss to crops and stored products in the United States through depredations of insects and rodents amounted to $2,250,000,000. Of all the insects the boll-weevil is the most destructive, and alone accounts for $300,000,000 annual injury to agricultural products. Similarly, of all ills in factory operation, poor lighting is the most frequent and the greatest offender. Based on laboratory data and practical tests in factories, it is estimated that poor lighting accounts for an annual loss of $4,500,000,000 due to lowered production and spoilage of material. This is fifteen times more damaging than the boll-weevil and twice as destructive as all the insects and rodents in the country.

In other words, a net saving of $4,500,000,000 worth of industrial products annually means a 10 per cent average increase in efficiency of production in every one of the 300,000 plants in the United States.

Strangely enough, while everyone believes in good lighting, few have it. Investigators tell us that in interviews with more than 500 factory executives 80 per cent of them expressed the view that efficient industrial lighting did actually increase production, decrease spoilage and reduce accidents, yet less than 20 per cent of our factories have really fair lighting, based on modern standards. Good lighting is like the Ten Commandments—everyone believes in them.

Consider the following statements on the requirements to be met in any good lighting system:

1. A steady light of sufficient intensity on all working surfaces whether in horizontal, vertical, or oblique planes.

2. A comparable distribution of light on adjacent areas and on the walls.

3. Light, of a color and spectral character, suited to the purpose for which it is employed.

4. Freedom from glare and glaring reflections.

5. Light so directed and diffused as to avoid objectionable shadows or contrasts of intensity.

6. A system which is simple, reliable, easy of maintenance, and reasonable in initial and operating costs.

The above generalities, properly interpreted, embrace the fundamental principles of good lighting, yet individuals might have widely diverse opinions as to the correct interpretation of any one of these items. Some attach importance to one par-

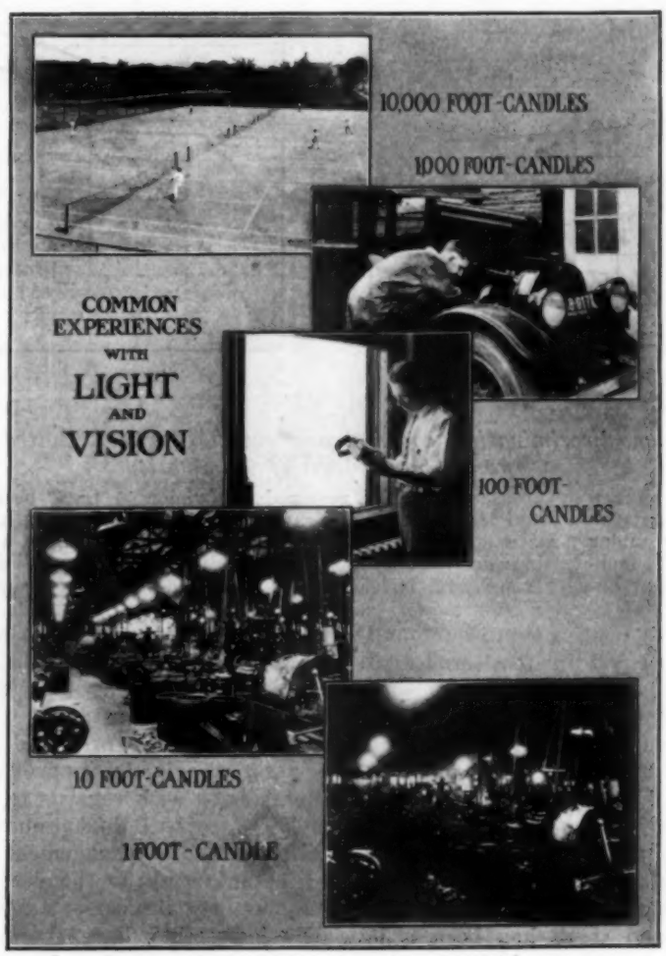


Fig. 1—A comparative illustration of illumination measured in foot-candles

ticular factor while others believe some other to be the criterion for good results. Many executives believe their factories are properly lighted because they meant them to be so. Good lighting, in the popular mind, can only be a relative term depending upon conclusions drawn from individual, personal experiences. Hence, in order to understand what the illuminating engineer means by good lighting we must forget the notions which we may have previously formed.

One of the first requirements, as stated, is an ample amount of light distributed on all working surfaces, with moderately lighted walls, ceilings and surroundings, this amount being specified in foot-candles, in general practice. The pictorial chart, Fig. 1, will help form a conception of foot-candle values that are commonly encountered in every-day life. Thus we see that by raising our industrial lighting standards from 1, 2, or perhaps 4 foot-candles, altogether too common today, to 10, 15, or even 40 foot-candles, for the best installations, we are actually providing far less illumination than the daylight under which the eye evolved.

One frequently hears discussions on higher standards of artificial lighting and there has been a lot written about "productive intensities" which have had their basis in numerous production tests in actual factories under various levels of illumination. Thus, a report from the U. S. Post Office Department showed an increase in efficiency of letter separators of 4.4 per cent when the illumination was raised from 3.6 to 8 foot-candles. Similarly, a report published in the Transactions of the Illumination Engineering Society, with reference to a test in the inspection department of the Timken Roller Bearing Co., showed a gain of 12.5 per cent in production at an added cost of only 2.5 per cent of the payroll.

Such practical evidence of what good lighting will do, and it is piling up every day, might well be dismissed with a wave of the hand if those reports dealt simply with providing light in dark areas which had previously been unlighted. Such, however, was not the case, for in all instances, fair average conditions of artificial lighting prevailed initially and the benefits accrued simply by improving the character of the illumination with regards to both quality and quantity.

The factory lighting question, at the outset, is a problem for the management rather than a routine task of the millwright or the electrician. Many an executive may lift a quizzical eyebrow at this, especially those who know they have thoroughly competent technical and operating staffs. The bearing that lighting has on production, spoilage, and accident prevention makes it worthy of the management's best thought.

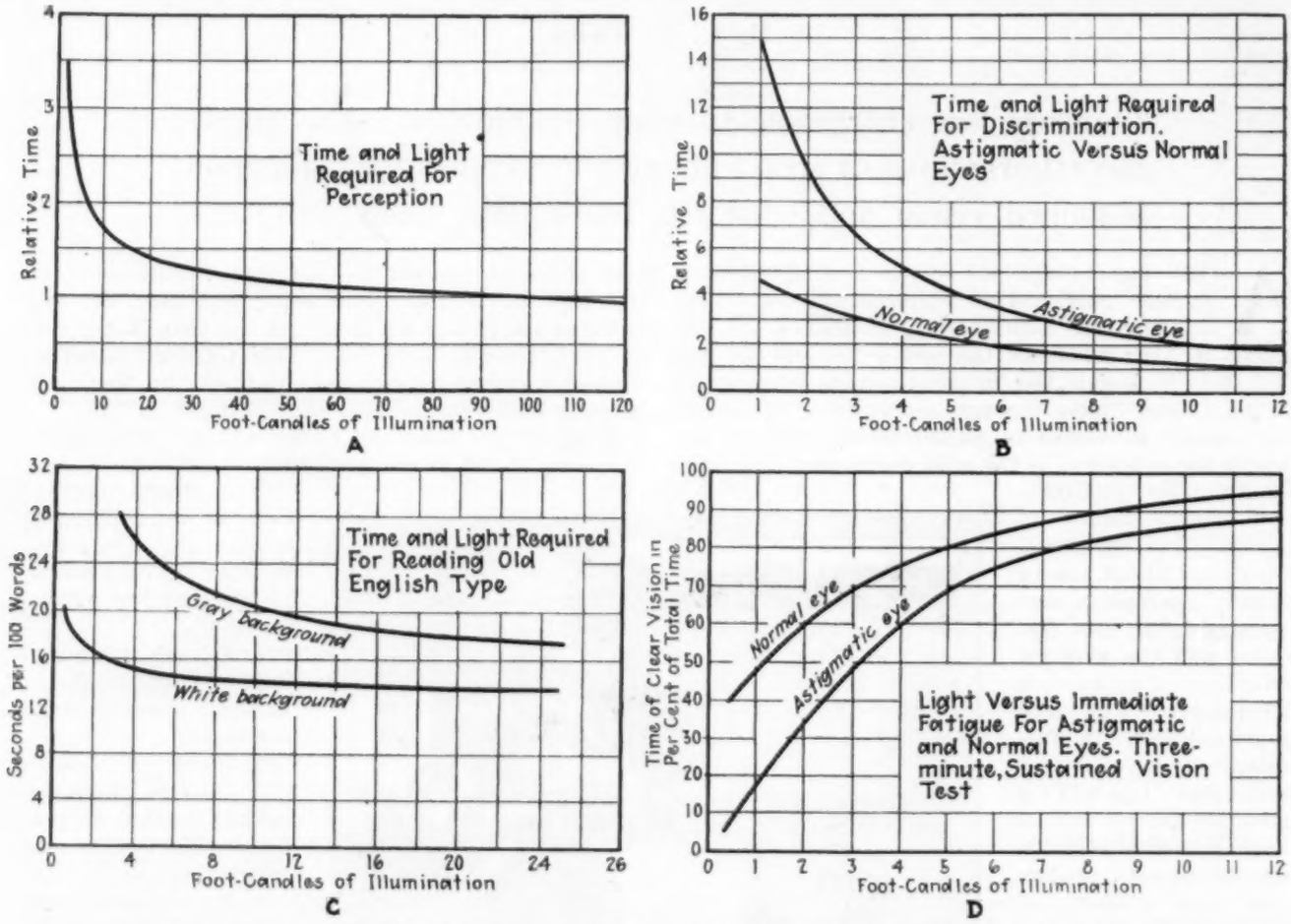


Fig. 2—Perception, discrimination, contrast and sustained vision plotted against time as affected by the level of illumination

A—To perceive the mere presence of an object, it will be noted that the eye requires 3½ times as long under 2 foot-candles as under 100 foot-candles. *B*—Higher illumination decreases the time required for vision and lessens the handicap of astigmatism. *C*—The time required for reading decreases as the illumination is raised, and is less with a sharp contrast between type and paper. *D*—Raising the illumination reduces eye fatigue, as measured by greater clearness of sustained vision, particularly benefiting the astigmatic eye.

Fig. 3—The foot-candle meter

It might be thought that lighting, of whatever quality, merely involves lamps, reflectors, wire, sockets, and a lot of other equipment which the technical staff could deal with competently. That, however, has too long been the attitude toward lighting practice. There has been too great a neglect of the fundamentals of vision, human reactions to light, and it is this consideration which makes the lighting problem one essentially for the executive.

The technical features of illumination design for factory work spaces, storages, offices, elevators, etc., are understood. The necessary equipment to accomplish a given purpose is readily available. It seems, therefore, that the most helpful information on illumination is not a sales promotion story of new developments in lamps or lighting equipment, but facts about ourselves and how our eyes use light. These facts are the essentials of illumination that are of interest to the executive. Once he has the proper perspective, or viewpoint, about light and its use, then providing proper lighting is a comparatively simple matter.

Saving time is the common objective of every efficiency effort. We do it by substituting machinery for hands and orderliness for lack of system, but wherever human eyes are used, if the light is inadequate, the hour is not long enough for the work it should contain. The eye, in its camera-like action, is forced to take time exposures instead of snapshots. These exposures are taken thousands of times a day, and the extra fractions of a second for each exposure spells an accumulated loss. Ample diffused illumination on the work can save this time, with less, rather than more, effort on the part of the operator.

The curves in Fig. 2 present basic facts which provide a direct link between light and time, between better illumination and increased production, decreased accidents, and the numerous other advantages which have invariably resulted. These data give only the briefest abstract of complete detailed reports which have appeared in scientific publications.

At *A* in Fig. 2, is shown the relation between the level of illumination and the simplest visual operation, perception. This curve illustrates the outcome of a series of tests in which a black dot was exposed momentarily on a white field. For each level of illumination the shortest exposure was found for which the subjects could detect the presence of the dot. The curve shows that at 2 or 3 foot-candles, which is a common value of artificial interior illumination, a relatively long time is required for perception. With an illumination of 10 to 20 foot-candles, which now represents good practice, the time required for perception is much less, decreasing steadily as the illumination is increased. This is to be expected, since the range of

Fig. 4—Measuring the illumination at a machine

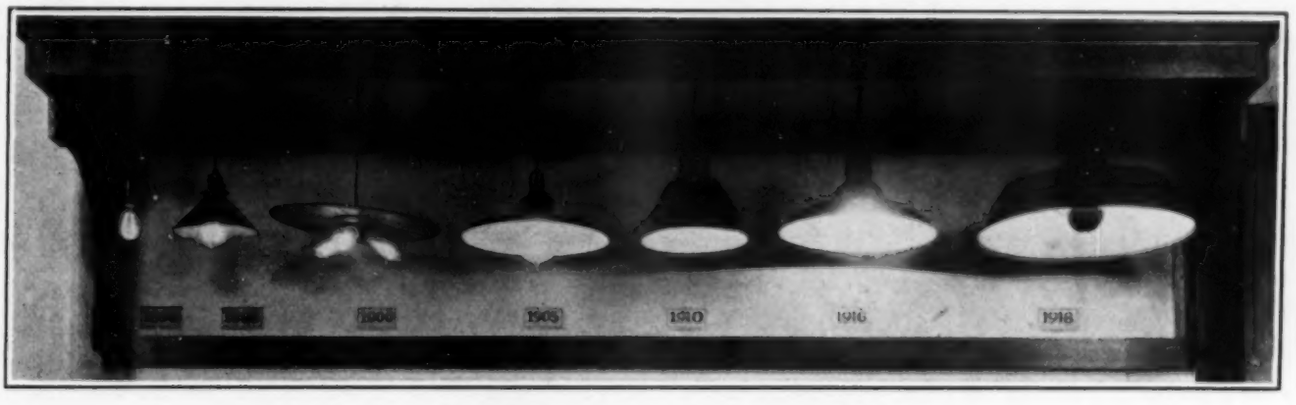


Fig. 5—Steps in the development of industrial lighting

The earlier developments in reflectors for industrial lighting met the needs of the times but for the most part they are inadequate from the standpoint of modern lighting, based on present day knowledge.

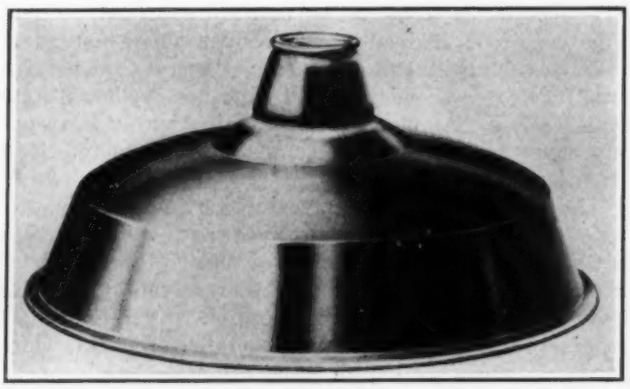


Fig. 6—The standard R.L.M. reflector

outdoor illumination, to which the eye has become accustomed through centuries of evolution, is usually from 100 foot-candles, corresponding to the waning illumination at sunset, to 10,000 foot-candles on a bright summer day.

Good vision requires more than the perception of an object; it requires the discrimination of its fine details as well. The speed with which this discrimination can be accomplished, or in other words the speed of vision, involves all factors of light and lighting which influence the ability of the eye to distinguish details by differences in brightness and color. Tests similar in character to the perception tests, have been conducted on the relation between the time required for discrimination and the amount of illumination. The results show the same general trend as that noted in the curve of Fig. 2 at *A*. The eye discriminates details more rapidly under the higher levels of illumination, although it requires more time than for perception.

Further tests have proved that an astigmatic eye always requires longer for discrimination than does a normal eye under the same illumination. The curves in Fig. 2 at *B*, covering the more common intensities of artificial lighting, show this fact. They also show that an increase in illumination benefits the astigmatic eye to a relatively greater extent than the normal eye. This fact is especially worthy of note, because more than half of the industrial workers of today have defective vision.

The practical value of these results has been verified

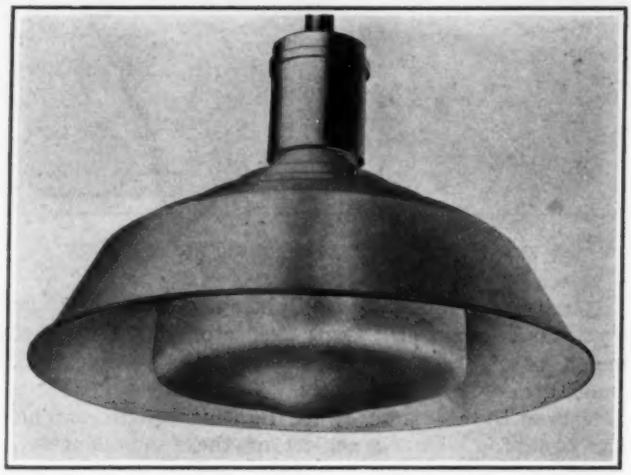


Fig. 7—The Glassteel diffuser

The manufacturers of these reflectors and diffusers submit their product for periodic test to the Electrical Testing Laboratories to insure the maintenance of the specifications as regards contour and quality of materials, slight deviations having a serious effect.

Fig. 8—Glassteel diffusers in the White Motor Co.

The units are spaced on 10-ft. x 10-ft. centers, and give a uniform illumination of over 10 foot-candles; 200-watt Mazda C lamps are being used at present but the wiring installed is of sufficient capacity to allow the use of 300-watt lamps whenever the accuracy of the work requires the higher level of illumination.

Fig. 9—Well-planned lighting in a machine shop

by a test on the speed of reading, shown in Fig. 2 at *C*. As would be expected, the time required to read 100 words becomes appreciably less as the illumination is raised. It will also be noted that reading is faster when there is a sharp contrast between the type and its background. This latter fact is significant, since in the every-day uses of the eye, with the single exception of the printed page, brightness contrasts are seldom found as pronounced as black on white, which is the best condition for clear vision.

When Details Become Blurred

It is a common experience that under a continuous gaze the eye becomes fatigued to such an extent that the details of the object viewed become blurred part of the time. Fig. 2 at *D* shows the results of tests which have established the fact that under low illumination a fixed gaze fatigues the eye rapidly, whereas raising the illumination improves the clearness of sustained vision to a considerable extent. Here again the astigmatic eye is handicapped even more than the normal eye by insufficient illumination.

The foregoing tests have demonstrated rather conclusively that by increasing the quantity of light the speed and accuracy of vision is increased. This is only true, however, where the eyes are not subjected to glare. It is generally known that the pupil contracts when the eye is exposed to glaring light sources. The practical effect of this contraction, which is Nature's "safety-valve," is usually overlooked.

When one looks at an object, its image is formed within the eye, and nerves transmit the picture to the brain. The fundamental factor in vision is the brightness of this image, which is proportional to the area of the pupil and to the brightness of the object viewed. In the absence of glare the pupil automatically expands, which is equivalent to increasing the illumination on the object viewed.

To illustrate this point, suppose a workman has 10 foot-candles upon his work, but because the light is so glaring, his pupils are contracted to a $\frac{1}{8}$-in. diameter. A second workman also has 10 foot-candles upon his work. The lighting units are of proper design and are hung well out of his direct line of vision. The absence of glare allows his pupils to expand to $\frac{3}{16}$-in. diameter. Then, since the brightness of the image within the eye is proportional to the square of the diameter of the pupil, the images of the second workman will be about twice as bright as those of the first workman. Even though the intensity of illumination of the work is exactly the same in the two cases, the

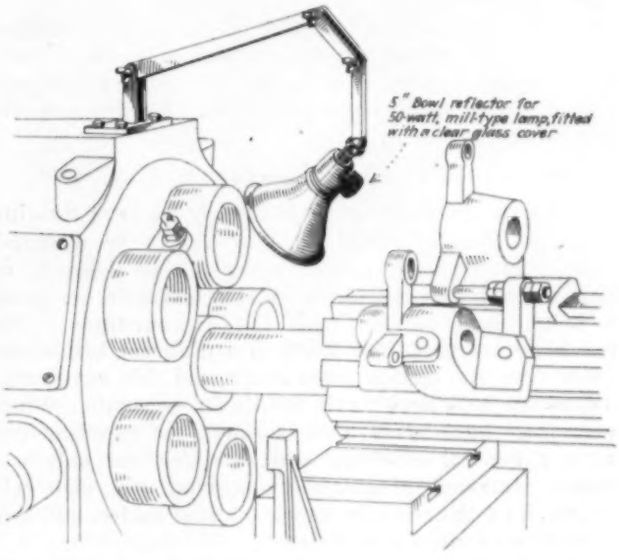


Fig. 10—Local lighting arrangement on an individual machine

In all cases local lighting should be supplemented by a moderate level of illumination supplied by a general overhead lighting system, scientifically laid out.

second workman is really enjoying the advantage of twice as much "seeing" light. His visual doorway is open a hundred per cent more than that of the first workman who is exposed to glare. There are other beneficial results arising from elimination of glare, such as greater comfort and safety, but the one just stated is directly measurable in terms of foot-candles.

The foregoing facts about light and vision describe good lighting from the standpoints of quantity and quality. They point clearly to the need for better and higher standards of illumination in our industries, namely, 10, 20, or even 50 foot-candles of illumination depending upon the visual requirements, with light sources properly shielded and placed so that the light is thoroughly diffused, softened, and distributed evenly to all working areas. From the practical point of view it is necessary to interpret these facts in terms of actual equipment and methods of installation which will guarantee their being taken properly into account.

By what means can one actually appraise his present lighting and judge how it measures up to economical standards? The experienced engineer who knows the detailed characteristics of lighting units, and who understands the installation features for their use under a variety of service conditions, can readily tell the shortcomings of any system by rather simple inspection. To the inexperienced, however, some of the most pertinent facts are not thus revealed. The simplest and easiest method of checking up on any lighting installation is by the use of the foot-candle meter.

Actually Measuring Light

This compact little instrument, shown in Fig. 3, has about the same dimensions as an ordinary cigar box and weighs about three pounds. It can be easily carried around from machine to machine and the amount of illumination can be measured here and there quickly, as illustrated in Fig. 4, with a fair degree of accuracy. It will show, instantly, the locations where the lighting is insufficient and will reveal defects in the spacing or type of the lighting units by indicating the lack of even light distribution.

Bright light sources should be completely shielded from the eyes except, perhaps, in high craneways where such sources can be mounted high enough to be outside of the normal range of vision. Shadows should be soft and luminous.

Local Lighting Alone Results in Contrasts

A lighting system consisting solely of local lighting units on the individual machines is to be shunned. True, such a system usually gives a high intensity of light immediately on the work, but there is too great a brightness contrast with the surroundings. The eye is forced to adjust itself to a different brightness every time the worker looks away, and this continuous seesawing back and forth results in eyestrain. Wherever local lighting is used it should be supplemented with a general overhead system which not only will relieve extreme brightness contrasts, but also will brighten up the shop, make supervision easier, and promote more sanitary conditions.

It was not the purpose of this article to set forth detailed information on lighting equipment or to give complete data for the correct design of lighting systems. It is meant, instead, to indicate to the reader briefly a few points which might fortify his judgment in lighting matters.

From the standpoint of proper equipment, however, there is a lesson in Fig. 5 which shows the steps in the development of industrial lighting reflectors. These have all been superseded by improved units such as the standard R.L.M. reflector, Fig. 6, and the Glassteel diffuser units shown in Fig. 7. If the factory is lighted by any one of these first seven types, representing different periods, it is probable that the most economical or most effective lighting is not being realized.

There are, of course, other modern types of reflectors suitable for industrial purposes but the R.L.M. reflector and the Glassteel diffuser are more universally applicable for industrial installations, particularly for the character of illumination required for the machine shop. For offices and drafting rooms semi-indirect or totally indirect lighting is preferable in all cases where the ceilings and walls are painted in light colors.

General Rules to Follow

It is difficult to give any simple rule for the installation of a lighting system that will fulfill all requirements and meet the particular conditions which exist in different plants. The proper spacing and mounting height of the units will vary with the ceiling height, but in general, the spacing between units should not exceed one and one-half times the mounting height of the units above the plane of work. The size of lamp depends, in turn, upon the room proportions, conditions of interior finish, and the character of the factory operations in their requirement for visual discrimination of small detail. Under average conditions, in medium sized rooms with the ordinary ceiling heights of 10 ft. to 12 ft., a simple but fairly safe rule is to install units 10 ft. apart each way and to use 200-watt Mazda C lamps. This will provide, roughly, 10 or 12 foot-candles of illumination on the working plane which is suitable for ordinary machine operations. For more detailed, or finer machine work, 300-watt lamps should be used, which will provide somewhat over 16 foot-candles. Figs. 8 and 9 show two typical examples of modern practice in machine shop lighting.

Expert Advice Is Available

For extra fine, high grade machine work, requiring discrimination of the finest detail, an intensity of 40 to 60 foot-candles is desirable. In such cases local lighting units, Fig. 10, supplementing the overhead general illumination, should be installed. These units consist of small, bowl-shaped, metal reflectors, mounted on flexible arms that can be adjusted to direct the light most effectively on the work. Small 25- or 50-watt lamps of mill-type construction are recommended. The units should, preferably, be fitted with clear glass cover-plates, across the opening, to exclude dirt, grease and lubricant from the lamp and the reflecting surfaces. They can be kept clean by wiping the outer surface of the glass cover-plate.

This article has touched upon the several points of illumination and lighting equipment so briefly that they are merely hints on the more important considerations. Complete information and data on the subject are widely available through the various lamp and reflector manufacturers. The need, first and foremost, exists for facts which will cause the industrial plant manager to view his lighting problem from the new and broader perspective of illumination results, rather than from that of lighting expenditures alone. Poor lighting is the boll-weevil of industry.

Automotive Production

The Con-Rod Line at Waukesha

By Wm. Thiel* and H. O. Schultz†
Waukesha Motor Co.

Application of standard machines with special fixtures —Some well thought out fixtures and jigs for limited production — Details of a good single-blade reamer

THE production problem at the plant of the Waukesha Motor Co. differs from that encountered in the engine shop of the average automobile manufacturer in that some eight or ten types of motors are being built in a shop of moderate size. As a consequence the parts go through in relatively small lots and machine set-ups must be changed for each lot.

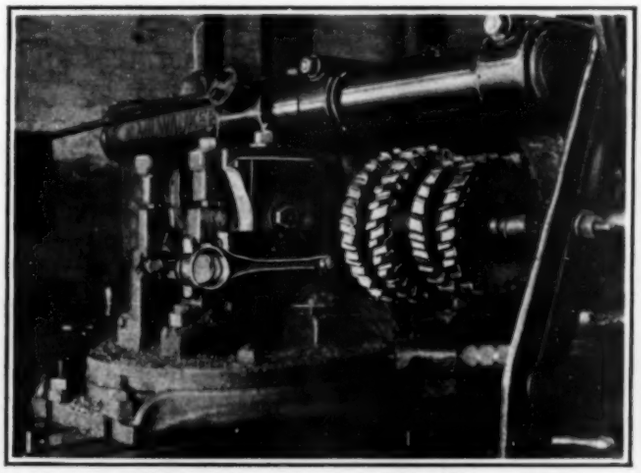
A good example of the way this particular problem has been worked out is found in the connecting-rod line. Standard machines equipped with special fixtures are used throughout to give a maximum production for the line of 100 sets, or 400 completed rods, per day.

Straddle milling of both ends is the first operation on the sandblasted forging as shown in Fig. 1. There are two indexing fixtures on the table of the Milwaukee milling machine, each holding two rods mounted end for end. The larger pair of cutters mills the big end of one rod while the smaller pair is milling the pin end of the other rod.

In the meantime the other fixture is unloaded. The first fixture is indexed on completion of the first cut and the opposite end of each rod is milled. While the machine is working the operator has time to reload the second fixture.

The second step is the drilling of the pin end and boring of the big end in a Foote-Burt four-spindle drill. Here again duplicate fixtures are used, one being loaded while the other is working, Fig. 2. Bolt holes are drilled and reamed in the indexing fixture shown in Fig. 3 under a Natco multiple-spindle drill.

For all rods except those used in the smallest motor built at Waukesha the next operation consists of grinding the hole in the big end. The big end of the small rod is babbitted and grinding is therefore unnecessary. The reason for introducing this step is to secure as perfect a contact as possible between the rod or cap and the bronze-backed babbitt bearing so that there will be no bar to rapid heat transfer. Truck and industrial motors work most of the time at somewhere near their maximum capacity and consequently the bearing surfaces must be right or the temperatures will run up and trouble will ensue. A Bryant chucking grinder is used and the work is held to ±0.0005 inch.



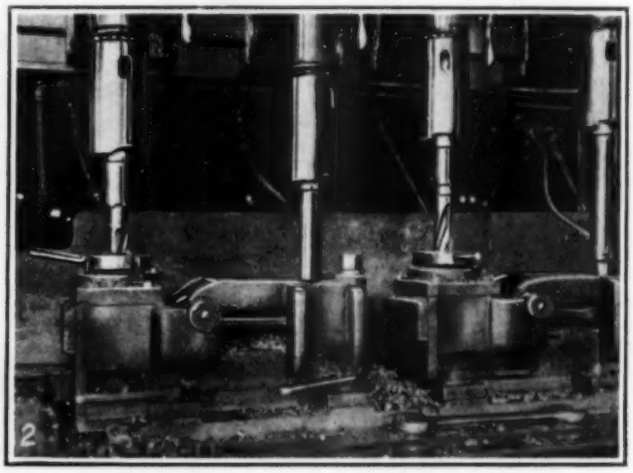
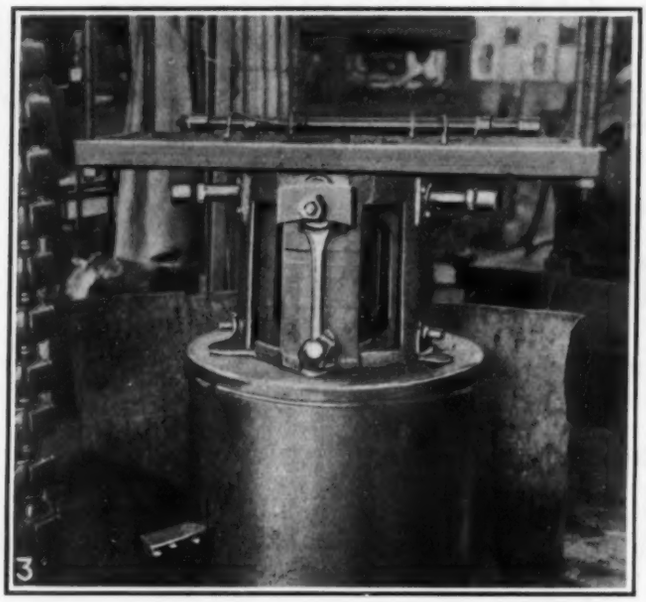
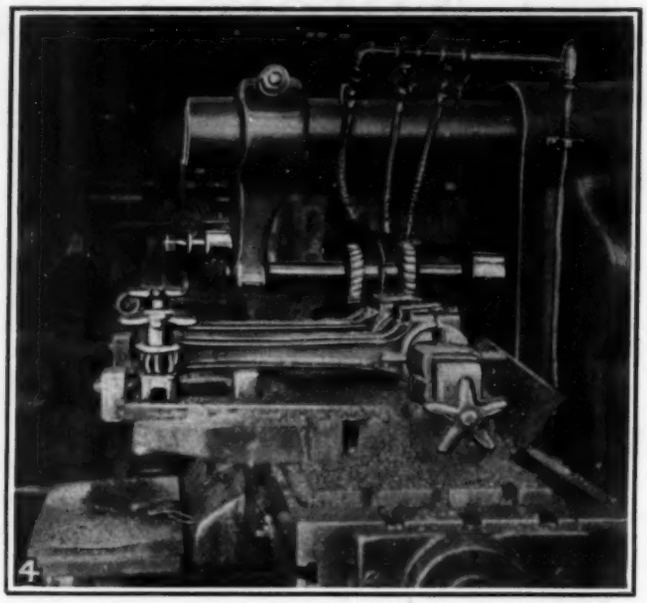


Fig. 1—Straddle-milling the rod ends. Fig. 2—Drilling and boring the bearing holes

*Production Manager. †Chief Tool Designer.

AUTOMOTIVE PRODUCTION





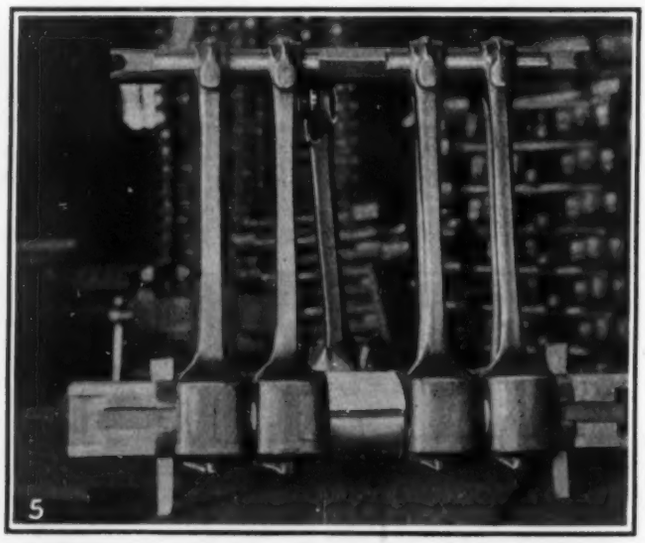


Fig. 3—Fixture for drilling bolt holes

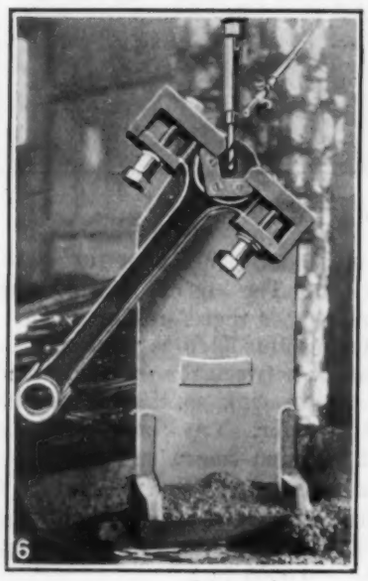
Fig. 4—Sawing off caps and facing bolt seats

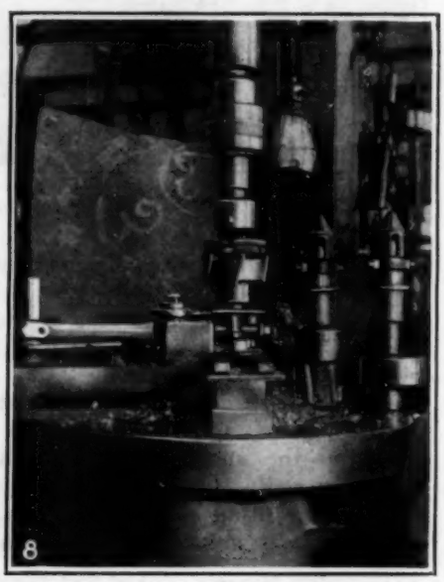
Fig. 5—Fixture for sawing operation

Fig. 6—Jig for drilling lock screw holes

Fig. 7—Fixture for face grinding bearing liner

Fig. 8—Tools for finishing big end bearing





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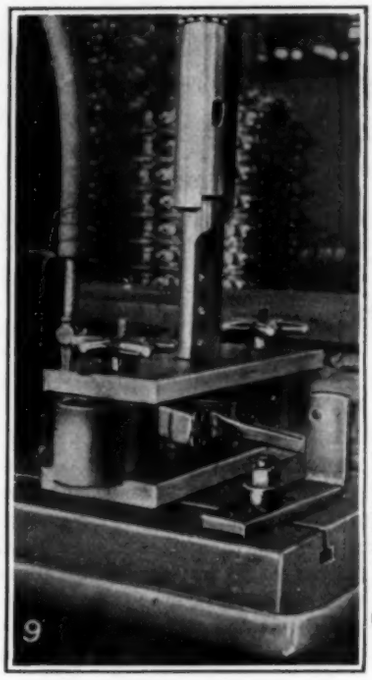


Fig. 9—Reaming the big end

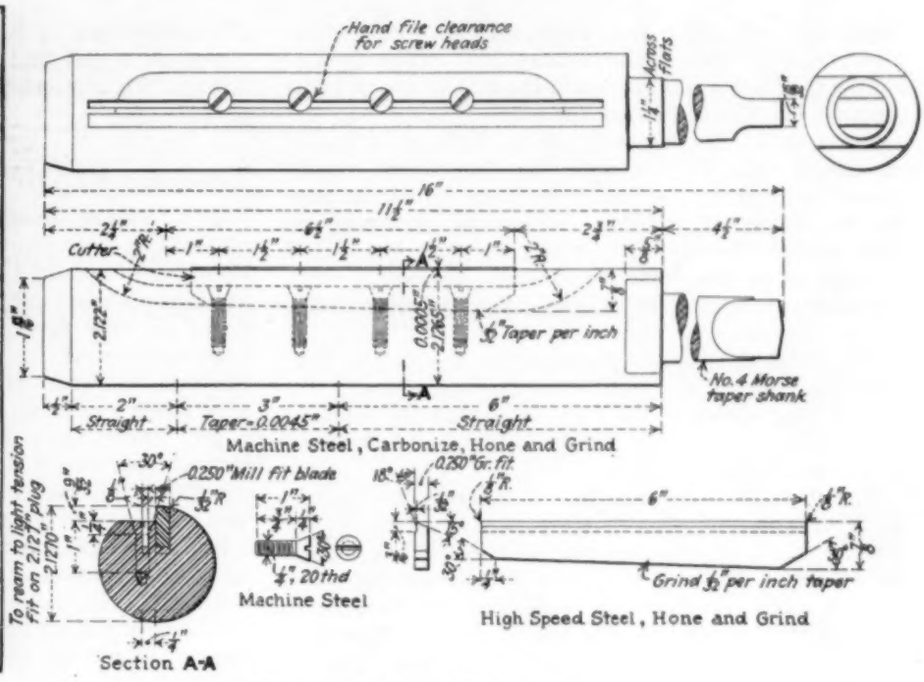


Fig. 10—Details of single-blade reamer

Next comes another milling operation as illustrated in Fig. 4. Here the caps are sawed off and the bolt seats are straddle milled. The simple two-mandrel fixture will be seen in Fig. 5. The rods are slipped on the upper mandrel and held in place by taper keys on the lower one. Fig. 4 shows how the mandrels are held on the table. An extra pair of mandrels is loaded while the cutters are working. The principle is the same as that employed in the other milling operation described except that the fixture must be removed and turned over instead of indexed.

In the larger rods bearing lock-screw holes must be drilled and tapped. The simple swinging fixture for the drilling operation is shown in Fig. 6.

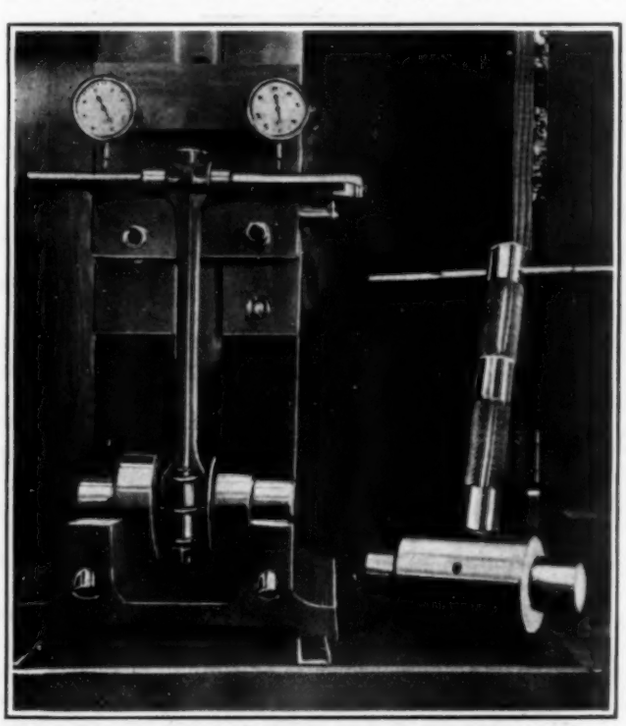


Fig. 11—Inspection fixture and master gage

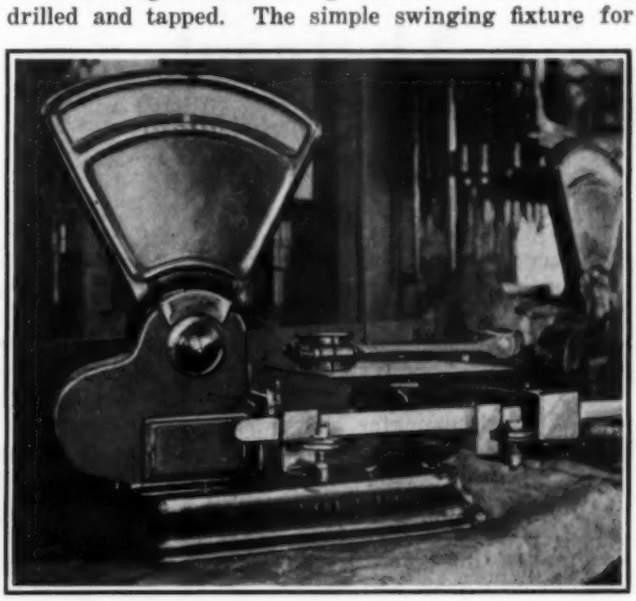


Fig. 12—Rod weighing scale

Both rods and caps, after the bearing liners have been fitted, are face ground on the Gardner disk grinder illustrated in Fig. 7. The fixture is designed to force the rod or cap against a half-round mandrel so that the bearing liner will be tight against the rod while the edges are being faced.

After the rod and cap are assembled the big end, with the liner in place, is bored and faced as shown in Fig. 8. A Foote-Burt drill press is used with four

tools, three of which are illustrated. The tool at the right faces the side of the bearing, that in the machine shapes the fillet while the one in the middle rough bores. Another one like it finishes the bore.

Reaming of the big-end hole is done in a Barnes camelback drill, Fig. 9, with the single-blade reamer shown in detail in Fig. 10. The blade is held in place by the action of the four screws in springing the thin tongue of metal left in the body against it. It is tapered on the bottom and rests against a corresponding taper so that it can be adjusted by being moved endwise.

The finished rods are inspected in the fixture illustrated in Fig. 11, for parallelism and squareness. The master gage shown at the right is used to set the three indicators. The gaging fixture is adjustable vertically to inspect different types of rods.

One more step remains before the rods are sent to stock or assembly—the weighing on a special Toledo scale, Fig. 12, so arranged that each end of the rod can be weighed. The dial will show the amount the rod is over or under weight when resting on the platform in the position shown. When placed on the two studs shown on the long bar in front of the scale the end resting on the left-hand stud will be weighed, that on the right-hand one being at the fulcrum of the lever. The counterweight can be positioned so that the dial will show the amount over or under weight as before.

Abstracts

from other publications

The Air-Cooled Engine

George S. Wheat writes on the great gains in efficiency that mark the development of this type of power plant.

Ten years ago Charles L. Lawrence, now vice-president of the Wright Aeronautical Corporation, started the development of a two-cylinder opposed air-cooled aviation engine that was later followed by a three-cylinder engine for small planes. The war interfered with this development in America, but the British during the war became so interested in large air-cooled engines that in 1919 they began to develop larger engines of this type, between 300 and 400 hp., and this led our own Army and Navy to test out successfully the three-cylinder design of Mr. Lawrence.

At present the Wright company is developing a large air-cooled engine for the Navy that incorporates all the experience it has gained to date and also the Navy department is using air-cooled engines in several of its planes—in its Vought UO-1's with the full military load of pilot and observer—the results showed the fuel consumption to be 0.48 lb. per horsepower-hour with an average speed of 78.7 miles per hour, getting 10.4 miles per gallon. The weight of this Wright air-cooled engine of 200 hp. was 440 lb. The plane completely equipped with its full military load weighed 2,300 lb. Some photographs are given of the different early types of air-cooled engine and there is also a photograph of the 200 hp. "J4" air-cooled engine.—*Aero Digest*, December, p. 367.

Training Repair Shop Mechanics

F. C. Smith, director of the Technical Departments of Y.M.C.A., contributes a paper in which he states that there are probably 200 different schools training automotive mechanics throughout the United States under possibly fifty different methods; most of these, however, are of the out-of-date type. The industry has been too busy with engineering and production to give much consideration for training men for service.

Mr. Smith then deals with the average mechanic who is about twenty-seven and a half years old, working reasonably fast and in an intelligent and confident manner. He is very friendly, courteous, cheerful, loyal and truthful in larger matters, but has a tendency to be inaccurate, impatient, disorderly and somewhat unresourceful. He changes his position every fifteen months and is experienced on all parts of a car, but master of none. He will try anything once because that has been his method of learning. He has little basic fundamental knowledge of principles of automotive construction or operation, and the "trial and error" method has been his teacher.

Mr. Smith then proceeds to point out that the present status in the education of this man cannot long continue. Either the industry will have to handle the problem in its own individual way or must set up its own schools to train "key men," or, more likely, it should recognize existing agencies and work in co-operation with them.—*Vocational Education Magazine*, November, p. 1057.

Sand Blasting

P. M. Heldt gives an article, well illustrated, dealing with a subject that is coming very much to the front, particularly in automotive work. Sand blasting is used at present in the following operations;

1—Cleaning drop forgings of scale.

2—Cleaning case-hardened parts, such as transmission gears, of scale.

3—Cleaning the brazed joints of such parts as motorcycle frames.

4—Producing a clean, uniform metallic surface on such parts as carburetor bodies that are not to be finished in any other way.

5—Cleaning the inside of such castings as cylinder blocks, gear cases, rear axle center cases, etc., of core sand.

6—Cleaning parts that are to be enameled, such as mudguards.

7—Cleaning surfaces of body panels, etc., that are to be painted.

8—Cleaning surfaces that are to be welded or brazed.

Mr. Heldt believes that metallic abrasives have a distinct advantage over sand or similar materials, stating that the metallic type retains its effectiveness twenty times as long as sand.—*Automotive Industries*, Jan. 22, p. 142.

Modern Gaging Methods and Gages

By Joseph Kaye Wood
Consulting Engineer, New York City

Working, inspection and master gages—Interchangeability—Types of fits—Modern gaging tools—Metal contact according to atomic theory

GAGING is the process of measuring manufactured material to assure the specified uniformity of size and contour required by the industries. The instruments, tools and other devices with which this process is accomplished are called gages. The nature of the gage depends upon the contour of the material that it measures and the general accuracy required.

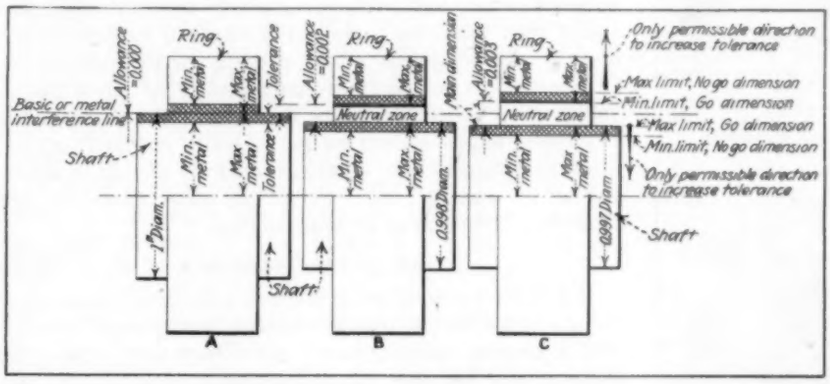


Fig. 1—Diagram of unilateral system of tolerances

Thus plug gages are used for holes while snap or ring gages are used for diameters, lengths and thicknesses. Both types have "go" and "no go" components, that are set according to the specified limits.

Another style of gage is known as the indicating type and consists of a fabrication of graduated scales, dials, flush pins and other components. Such devices are used for visual examination of dimensional uniformity in contour and the relationship of different surfaces. A third type consists of functional gages that define all essential dimensional requirements of the manufactured part, or partial assembly, in actual service operation.

The underlying purpose of modern gaging systems is to secure economy through the interchangeability of mechanical parts manufactured in great quantities. The economy obtained in this manner is due to concentration of similar work in a location most suited as regards labor, materials and organization of production. The limitations of such a system are naturally quite definite and depend upon the type of work to be produced and the interchangeability required to obtain the maximum economy in production and in replacement or repair work as well. For example, during war time maximum interchangeability is desired, on account of the vast production of numerous elementary parts in widely scattered sections of the country. The question of geographical location is very important, because of the variation of customs and practices as regards manufacture.

The gages referred to above are called the "working gages" and, as explained, they are used by the machine shop man to check and control the work dimensionally as it is being produced. For maximum interchangeability, the working-gage system is very elaborate, one gage being required for each operation. In a system of this kind there may be as many as 1,200 working gages for about 100 mechanical parts. It has been the practice to make these gages with tolerances equal to 80 per cent of the permissible tolerance on the manufactured part. Modern practice however requires strict adherence to the axiom that limit gages must be practically independent of wear.

Inspectors remeasure the finished pieces turned out by the individual operators and use "inspection" gages for this purpose. It has been the practice to make these

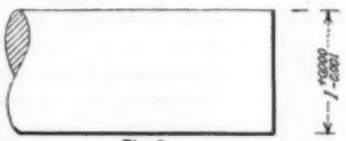


Fig. 2

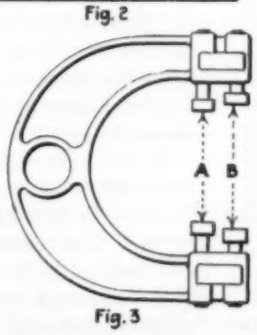


Fig. 3

Fig. 2—Shaft to be produced. Fig. 3—Gage to control diameter of shaft

Relative Limits of Different Production Gages and the Accuracy to which They Are Made

Type of Gage	Normal Size in inches		Gage-Making Size in inches	
	A	B	A	B
Working	0.9990	1.0000	0.9990 +0.0000 −0.0003	1.0000 +0.0003 −0.0000
Inspection	0.9987	1.0003	0.9987 +0.0001 −0.0001	1.0003 +0.0001 −0.0001
Salvage	0.9983	1.0007	0.9983 +0.0000 −0.0002	1.0007 +0.0002 −0.0000
Master	0.9987	1.0003	0.9987 +0.00005 −0.00005	1.0003 +0.00005 −0.00005

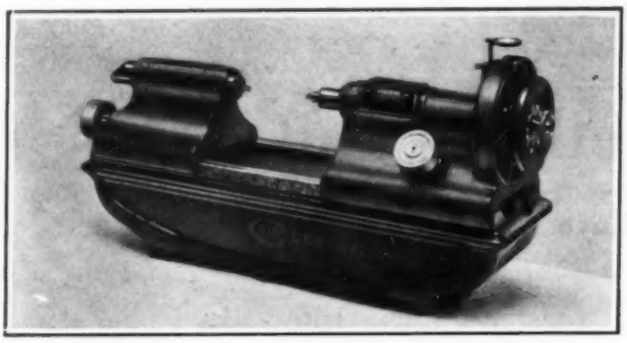


Fig. 4—Société Genevoise precision bench micrometer

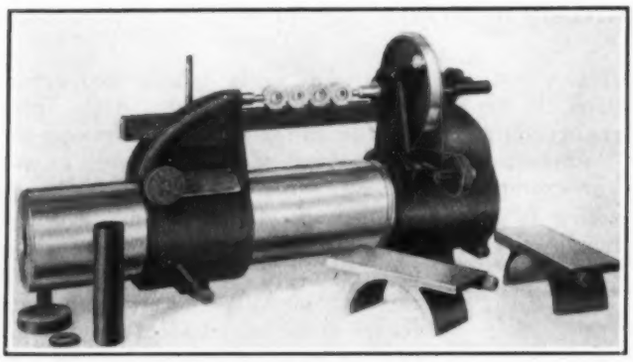


Fig. 5—Pratt & Whitney "Supermicrometer," showing the method of setting up with standard inches

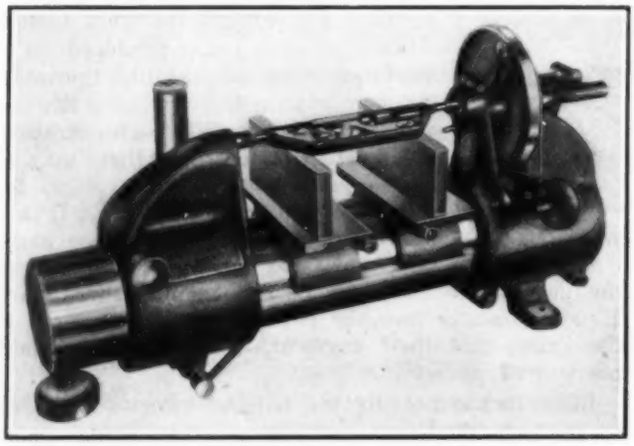


Fig. 6—Setting a gaging tool with the Pratt & Whitney "Supermicrometer"

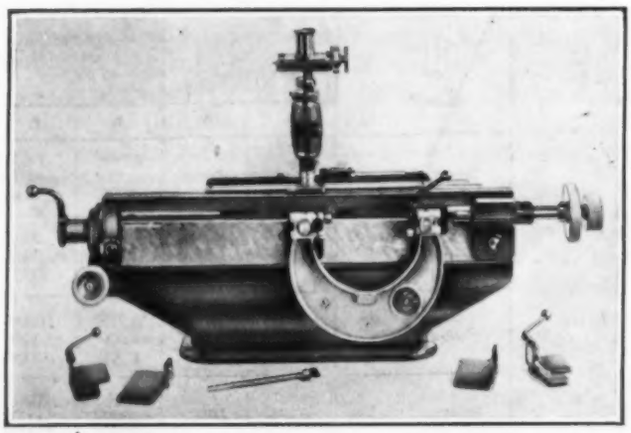


Fig. 7—Société Genevoise machine for setting adjustable snap gages with an accuracy of 0.0001 inch.

gages with tolerances equal to 90 per cent of the permissible tolerances on the manufactured piece, but modern gaging practice also requires these gages to be independent of wear. However they are usually from two to five times more accurately made than the working gages, in order to avoid any controversy between the inspection department and the operating or manufacturing department, particularly if the inspection is conducted by the purchaser. This superiority on the part of the inspectors is essential, since the result of their check with the inspection gage determines whether or not the piece will be rejected. Practically, however, the working gages are now usually made with the same or less tolerance limits as the inspection gages, so that they should not accept any product which the latter will reject.

Salvage gages, which may be considered as combinations of working and inspection gages, are of course made with greater tolerances than for gages controlling newly manufactured parts. Just how much greater this tolerance should be is determined by the permissible maximum wear or distortion of the piece that will still give satisfactory operation.

Working, inspection and salvage gages are naturally bound to wear with use, particularly the first type, and hence they must be periodically checked against reference or master gages, either directly or by comparison.

In order to insure interchangeability of parts manufactured in widely scattered sections of the country, the reference gages should be periodically checked against standard gages whose legal authenticity should be established by having their deviation ascertained by the Bureau of Standards at Washington.

Limits for Tolerance

We could never hope to establish the interchangeability principle in the manufacturing world while employing a gaging system which permitted only single flat dimensions, because, in attempting to do this, the real and only purpose of interchangeability, i.e., economy, would be defeated. In other words, speed, which is a very important factor in mass production, gives rise to dimensional variation because of the human element and machining operations. A tolerance principle has therefore been incorporated in gaging systems in order to permit suitable variations in manufacture. The variation in diameter prescribed by the tolerance limits is determined by making a compromise between the functional requirements of the mechanism into which the part is assembled and the cost of production.

Definitions of "tolerance" and "allowance," as developed by the A.S.M.E. Sectional Committee on the Standardization of Plain Limit Gages, are as follows:

Tolerance is a definite difference in the dimensions in manufacture. It is equal to the difference between the maximum and minimum sizes.

Allowance is a difference in dimensions of mating parts, the limits of which are prescribed. It is to provide for different kinds or classes of fits. It represents maximum tightness or minimum looseness.

All limit gages are made or adjusted to measure readily the minimum and maximum limits, and hence for this specific reason they might well be called "tolerance gages." One gage of this tolerance pair is called the "go" gage and in the general case of holes it controls the minimum limit, while the other gage is called the "no go" gage and controls the maximum limit. Structurally these gages are characterized as plug gages.

Ring gages are used for controlling the tolerance limit of a plug or shaft, the "go" type controlling the maximum limit and the "no go" the minimum limit.

When the tolerance limits are considered for two co-functional mechanical parts, for example the hole in a bushing and the diameter of a shaft that fits in it, certain complications arise due to the tightness or looseness of the fit required. In order to insure strict interchangeability and lack of confusion in the consideration of co-related tolerances of the kind just mentioned, some fixed point must be definitely related to the basic or standard dimension. In modern gaging systems used by manufacturers in the United States, the unilateral system of tolerances has been largely incorporated, because of economy in gages and lack of confusion.

In Fig. 1 are shown three types of fits, a zero allowance at *A*, an allowance of 0.002 in. at *B* and an allowance of 0.003 in. at *C*. These allowances give the maximum metal in the mating parts and are determined by subtracting the main dimension of the shaft from the main dimension of the hole. Tolerance for each of the cases shown can be applied only in a direction shown by the arrows and always produces a looser fit.

It can be seen readily that, when gages are made for any one of these fits and the tolerances are changed, only one "go" gage is necessary for all variations, but, of course, separate "no go" gages are required. This is the advantage of the unilateral system, in addition to its being easier to manipulate mentally. Another great advantage of this system is that the "go" gages can easily be made to standard gage dimensions, thereby permitting easy checking. The manner in which such limits or tolerances are shown on drawings is also a very good feature of the unilateral system. For example, limits in *A* would be written as follows:

Hole, 1.000 in.	$^{+.002}_{-.000}$ or 1.000 in.	$^{+.003}_{-.000}$ or 1.000 in.	$^{+n}_{-.000}$
Shaft, 1.000 in.	$^{+.000}_{-.002}$ or 1.000 in.	$^{+.000}_{-.003}$ or 1.000 in.	$^{+.000}_{-n}$

Limits in *B* would be written as follows:

Hole, 1.000 in.	$^{+.002}_{-.000}$ or 1.000 in.	$^{+.003}_{-.000}$ or 1.000 in.	$^{+n}_{-.000}$
Shaft, 0.998 in.	$^{+.000}_{-.002}$ or 0.998 in.	$^{+.000}_{-.003}$ or 0.998 in.	$^{+.000}_{-n}$

Limits in *C* would be written as follows:

Hole, 1,000 in.	$^{+.002}_{-.000}$ or 1.000 in.	$^{+.003}_{-.000}$ or 1.000 in.	$^{+n}_{-.000}$
Shaft, 0.997 in.	$^{+.000}_{-.002}$ or 0.997 in.	$^{+.000}_{-.003}$ or 0.997 in.	$^{+.000}_{-n}$

In every case the "go" gage for the hole would be 1.00 inch and hence easily checked against a standard gage.

The foregoing system has advantages in actual machining operations as, for example, in the use of solid reamers. A reamer as it wears in service can be used consecutively for each grade of fit before it is scrapped.

The application of the unilateral system to the complete set of production gages may be summarized by the consideration of the following specific example. Production of the shaft shown in Fig. 2 is to be controlled dimensionally by the type of gage shown in Fig. 3. The table shows at a glance the relative amounts of accuracy required of the various types of gages and the degree of accuracy to which they in turn are manufactured and checked. The unilateral tolerance system is used, *A* being the minimum or "no go" limit and *B* the "go" or maximum limit.

Where possible working gages consist of the plug, snap or ring "go" and "no go" type but very often the mechanical part is not round. In such cases "go" and "no go" jigs or templets are built specially, and the more complicated the contour of the piece the more costly will be the gaging tool. In modern gaging methods, these tools are often provided with dials having two-way scales and multiplying levers in place of "go" and "no go" or flush-pin surfaces. For functional gages or very complicated working gages all distances

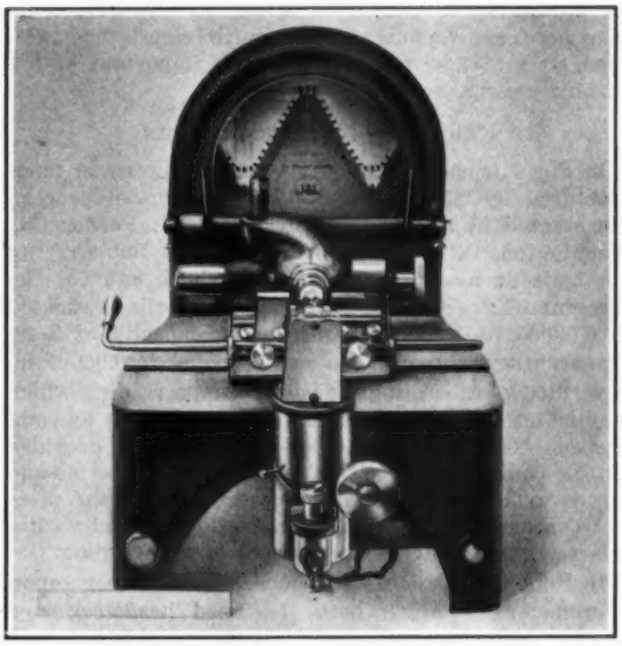


Fig. 8—Hartness screw thread comparator, bench type

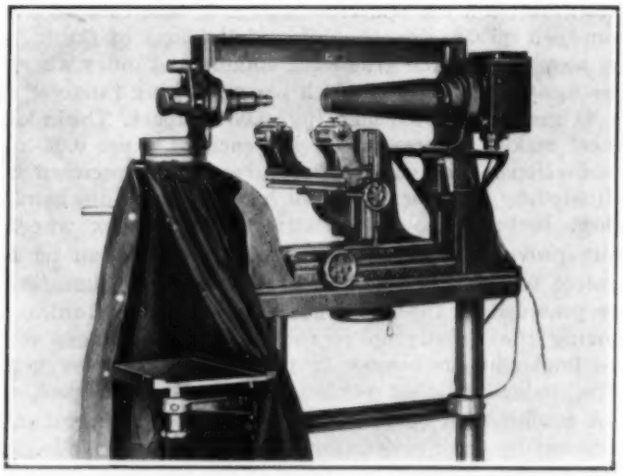


Fig. 9—Bausch & Lomb contour-measuring projector

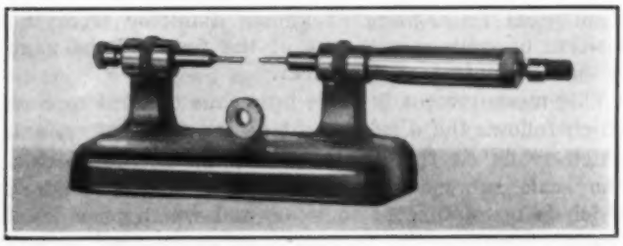


Fig. 10—Brown & Sharpe bench micrometer caliper

are taken from a single point called the locating point.

The use of dial or indicating gages has the advantage of reducing the number of gages required, and eliminating the errors due to wear. Since it is an axiom that limit gages must be practically independent of the conditions due to wear and temperature changes, it seems inconsistent to disregard the variations of the operator in feeling a dimension with a worn gage. With this fact in mind, the leading gage manufacturers have devoted considerable time and effort in producing accurate-reading dials, supersensitive micrometers, optical devices for measuring or comparing screw threads, adjustable snap gages and various types of multiplying-lever gages. Figs. 4 to 9 show some of the most important of the modern gaging tools.

Examples of Precision Gages

In Fig. 4 is shown a precision bench micrometer manufactured by Société Genevoise, a European concern represented in this country by the R. Y. Ferner Co., Washington, D. C. It is intended chiefly for carrying out tests or measurements in workshops and for the checking of gages. The micrometer screw is graduated to 0.00005 in. and has a measuring capacity of 2 in. The accuracy is guaranteed by the maker to 0.00005 in. A vernier gives readings to 0.00005 in., a reading which may be useful when performing measurements by comparison. The tailstock of the instrument is provided with a contact indicator graduated to 0.00004 in. and serves to insure a constant pressure against the piece to be measured. The tailstock is also provided with a setscrew for setting the instrument to zero reading.

In Figs. 5 and 6 is shown the Pratt & Whitney supermicrometer in which both the fixed headstock containing the measuring spindle and the movable footstock are mounted on a rigid, cylindrical bed of large diameter, having a three-point support. Standard inches, shown between the spindles in Fig. 5, take care of the even-inch measurements while subdivisions of the inch are measured by the graduated spindle and index wheel. The measuring spindle, which has a working range of ½ in., is graduated with markings 0.05 in. apart. The index wheel makes one revolution for each of these 0.05-in. graduations. The contact pressure on the specimen is adjusted by turning the small handwheel. This handwheel is belted to the relatively large index wheel, thus providing the element of slip or friction as a control for constant-contact pressure. Two diameters are provided on the handwheel, the smaller for quickly moving the spindle up to contact and the larger for the final slow movement to the point where the belt slips, indicating that perfect contact is established.

A machine for setting adjustable snap gages, manufactured by the Société Genevoise, is shown in Fig. 7. The distance between the faces of the snap gage is not estimated, but is definitely determined to a high order of accuracy by measuring exactly the displacement of a spherical feeler-piece of known diameter from the position of contact with one of the faces of the gage to that of contact on the other.

This measurement is made by means of a microscope which follows the displacement of the feeler-piece, and which reads on the graduation of an accurate scale. The scale serves the purpose of a single standard which is not subjected to wear, and which provides a means of setting the various snap gages used in any workshop, whatever their dimensions. In order to eliminate the effect of elastic deformation which might arise from the pressure exerted by the feeler-piece on the faces of the gage, a contact indicator is used, consisting of a needle indicator having a sensitivity of 0.00005 inch.

The machine carries two screwdrivers, the functions of which are to move the adjusting and fixing screws connected to the measuring faces of the gage. The latter is fixed on a slide resting on the bed of the machine and the method of fixing is so arranged that the gage is held firmly but without distortion.

The bench type of the Hartness screw thread comparator, made by the Jones & Lamson Machine Co., is illustrated in Fig. 8. This measuring machine is essentially a comparator in principle, comparing, as it does, all threads with a master screw which is known to be correct. The comparison is rapid since the projected shadow is greatly magnified and can be visualized readily. The instrument is adjusted by staging a master gage in the cradles so that the shadow of the thread directly in front of the lens will coincide with

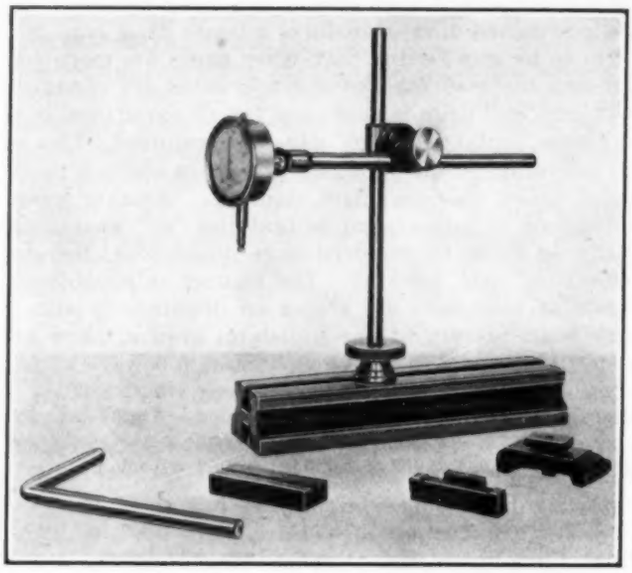


Fig. 11—Brown & Sharpe dial test indicator

the upper outline on the chart. When the shadow of the thread is projected on the tolerance chart, adjusted in this manner, it represents a perfect screw in a perfect nut. The master gage is then replaced by the production screw to be checked. To pass inspection, the shadow of the production thread must fall between the upper (maximum) outline and the lower (minimum) outline on the chart. The space between the maximum and minimum outlines represents the permissible tolerance, which is determined by the class of fit required. If the shadow of the production thread is displaced longitudinally it shows that there is an error in lead; vertical displacement of the shadow represents pitch-diameter variation.

The Bausch & Lomb Optical Co. has recently put on the market a scientific measuring projector that, in addition to measuring screw threads, measures all intricate types of contours. The contour measuring projector, illustrated in Fig. 9, consists of a highly perfected optical system, with suitable mechanical parts to protect and support it, to hold the work in proper position, and to provide all necessary adjustments and means for making measurements.

In Fig. 10 is shown the bench micrometer made by the Brown & Sharpe Manufacturing Co., which is really a mounted micrometer caliper that is particularly useful for taking quick and accurate measurements. A clamp ring is used for clamping the spindle and preserving the setting so that a series of uniform measurements can be taken.

For all measurements from 0 to 1 in. the tool is used as shown. When the anvil is drawn out measurements from 1 in. to 1 in. can be taken. The measuring points are $\frac{3}{8}$ in. in diameter and are particularly useful when small pieces are to be measured. A standard 1-in. gage is shown on the stand ready for checking purposes. Each graduation corresponds to a spindle movement of 0.001 inch.

A Brown & Sharpe dial gage is shown in Fig. 11. It is useful for determining the inaccuracy in a surface or the movements of a spindle or arbor and for close work difficult of access. The pointer is sensitive to a movement of 0.001 in., each graduation of the dial scale corresponding to 0.001 in., with a total scale reading of 0.3 in. The horizontal arm is adjustable to any angle.

The usefulness, speed and accuracy of such projection systems as described for intricate contours cannot be overemphasized.

Reference and Standard Gages

Many of the special gages mentioned as working gages are also used for checking the latter; but under more accurate conditions as regards temperature variation and errors of chance, since in this case a flat dimension is being set. To check these reference gages, high precision and measuring machines, gaging blocks and light-interference methods are used, which obtain their authenticity directly from the standard dimension in the Bureau of Standards at Washington. The checking in modern shops is usually done in distinctly separate rooms, air conditioned to eliminate possible corrosion and kept at a constant temperature of about 68 deg. F. When working gages are checked, some system that automatically provides a definite periodicity is established.

In accurate checking of gages, metal contact, being very important, is taken care of by either providing very accurate surfaces on both the gage and measuring spindles, or keeping the contact pressure accurately constant. Accurate surfaces are readily determined by their ability to "wring" together, a property due to atomic forces at the metal surfaces. Johansson, at a lecture held Nov. 10, 1917, in the Stockholm Technical Institute, in Stockholm, before the Physiological Society, stated that this force is more than thirty times atmospheric pressure, or 420 lb. per sq.in., for steel surfaces. The availability of such enormous atomic power is probably explained as follows:

At *A*, in Fig. 12, is represented an infinitesimal section of the end of a gage, while at *B* is represented a similar section of a Johansson block. The black dots represent the centers of atoms in the atomic space lattice (the body centered being assumed for simplicity), and the loops represent the electro-magnetic circuits which, by interlocking, hold the atoms in position. The section of the Johansson block will be considered as representative of the entire surface, while that of the gage will be likewise considered.

Hence, for the conditions specified, it is quite obvious that most of the loops on the end of the block will not be engaged; but, by further lapping of the gage-end, many or all of the channels like that shown will be eliminated and a condition as shown at *C*, in which all or nearly all of the end loops are engaged, will be the result. The directions of the flux-flow in these loops are indicated in the diagram by means of arrows. They show that when the resulting attractive force of one atom is multiplied by the great number of atoms at the two very accurate surfaces the total "wringing force" must be enormous, as pointed out by Johansson.

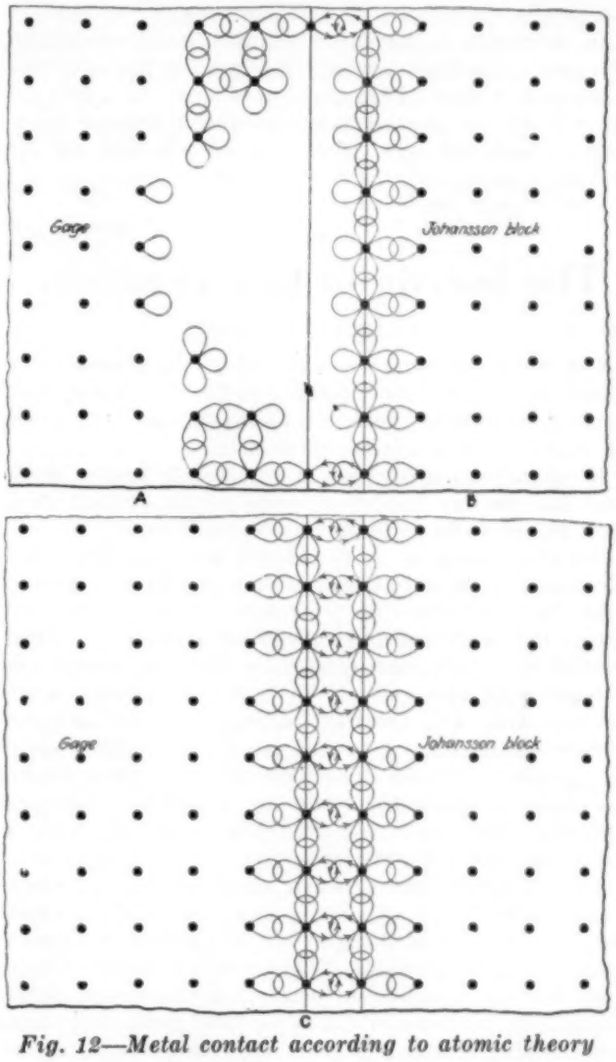


Fig. 12—Metal contact according to atomic theory

Actually, not all of the end loops can be engaged, or we should then expect the "wringing force" to be equal to the ultimate strength of steel; but certainly an unusually great number must be engaged to give a strength of 420 lb. per sq.in. Thermic vibrations of the atoms, which are greatly reduced in amplitude for the solid metals, naturally must prevent the perfect cohesion obtained in re-melting; but it is not necessary to go into this phase of the question.

Another very good method by which accurate surfaces may be checked is the light interference method employing the optical flat. This method, however, has been well covered in previous issues of the *American Machinist*.*

The constant-pressure method of taking care of the errors due to metal contact does not depend upon such

*Vol. 53 pp. 107, 627 and 674.

extremely accurate surfaces. It might be argued that this method is not so exact as the accurate-surface method, since an equal contact pressure between different surfaces might not always produce the same degree of compression. For practical manufacturing purposes, however, this is sufficiently accurate when only two pairs of metal contacts are involved. Where many pairs of metal contacts are involved, only accurate surfaces can be tolerated, which is attested by the fact that when many Johansson blocks are "wrung together," no appreciable error is noticed, although of course the errors may be compensating.

In conclusion it is pointed out that in the production of a new or modified product, the first few pieces, sometimes called tool-made samples, should be carefully checked by the engineering department from a functional standpoint, which will prove whether or not service requirements have been met in regard to the gaging system employed.

The Inertia of Conservatism

By Leroy L. Thwing

IN A recent magazine article Dr. R. A. Fessenden, a well known inventor of electrical devices, in a discussion of conditions precedent to inventions, lays down the following as a fundamental law:

No organization engaged in any specific field of work ever invents any important development in that field, until forced to do so by outside competition.

He then proceeds to enumerate fourteen important inventions in substantiation of this statement. Among these he cites that the telegraph companies did not invent the telephone and refused to purchase it when offered; the telephone companies did not invent the wireless and also refused to purchase patents when offered. And so on from soft collars to steam turbines.

Whether or not this law of Dr. Fessenden's is based on sufficient evidence is perhaps not important, as the conditions forming the basis for it are at least very common. This law, if it is a law, seems to imply a condition wherein our industries do not forget anything old and refuse to learn anything radically new. On the other hand, of course, there is the old proverb about the cobbler sticking to his last and the necessary conservatism of capital. There are presumably conditions that favor and even justify few changes in either the articles produced or the methods of producing them. For example, stability is more likely to be found in the older arts such as the textile industry. This is indeed the case, for although fabrics change in design, the tools of the art have changed very little during the past twenty years. Conversely the automobile industry is comparatively new and both the product and the methods of production are in a constant condition of change and improvement.

Another angle on the situation is the nature of the controlling business interests. Are they controlled by business men and bankers or by engineers and inventors? The first are entirely satisfied to let well enough alone so long as the business is profitable while the others might like to make a change every time they have a new idea. The first condition is found today in the New England textile mills and the second in about every small shop that is controlled by an inventor.

It is evident that an executive with a background of financial training rather than technical or shop experience is at least one step removed from the operating official's perspective and does not see the specific need for new equipment as quickly as the shop trained man. Any executive knows that new products and methods cannot be adopted too freely if it involves too great a loss in equipment rendered obsolete by the change, to say nothing of the expense of development.

Notwithstanding these checks and balances is there any good reason why some one of the steam engine builders should not have developed a turbine? The full reason why they did not is probably the sum of many details, but it is not unreasonable to believe that prominent among them was the fact that they did not believe that anything would ever supplant the reciprocating engine. No planer company that the writer can recall ever developed even a planer type of milling machine nor any drill manufacturer the high-speed ball-bearing drill. Until very recently no lathe manufacturer has developed his machines in the direction of multiple tooling or semi-automatic operation. And yet the management of the machine tool industry is closer to the operating end of the business than in other basic industries. This condition may well account for the fact that the progress in machine tool design is probably greater than in any of the older industries. There is no yardstick to measure this improvement, but as compared with textile machinery and iron and steel producing equipment it appears to be true.

Effect of Conditions

This condition has its weak side as well, because an inventor's antagonism toward another's ideas is far less judicial than the indifference of the most conservative banker. We see the effect of this when we note the lack of response to any attempt in the direction of standardization of machine tools. The machine tool builder—particularly the type of a decade ago—is very much of an individualist and often appeared to be in the business for the fun he got out of it as a designer or builder.

To return to Professor Fessenden's law, it appears that the basic cause of it is a too firm belief in our own products and methods together with an inbreeding of ideas and the inertia of long-established practices. There is no reason to believe that machine tool builders particularly need these conditions delineated for them but they are thoughts that it is well to take a dose of occasionally.

Census of Steel Works and Rolling Mills

The Department of Commerce announces that, according to the data collected at the biennial census of manufactures, 1923, the value of the total output of steel works and rolling mills amounted to $3,154,324,671, an increase of 112.9 per cent as compared with $1,481,659,352 in 1921, and of 11.5 per cent as compared with $2,828,902,376 in 1919.

Of the 489 establishments reporting for 1923, 186 were located in Pennsylvania, 81 in Ohio, 31 in New York, 30 in Illinois, 25 in Indiana, 19 in New Jersey, 17 in West Virginia, 14 in Massachusetts, 12 in Wisconsin, and 74 in 20 other states. In 1921 the industry was represented by 494 establishments, the decrease to 489 in 1923 having been due to consolidations.

Orifice Design in Sandblast Nozzles

By Louis D. Peik

THE sizes and types of sandblast nozzles found in the field vary greatly, but the same law as to the wearing contour holds good in nearly every case. An operator who believes that a particular nozzle is better because it wears longer may be ignorant of the fact that it also is less efficient in the blasting effect on the work. For this reason the following data will be of practical value in the guidance of those operating sandblast equipment. A nozzle is shown in Fig. 1, that is commonly used for general work. The hole *D* through the nozzle was straight when new, but has been worn to the point where any further wear would enlarge the inlet and thus increase the effective size. Just how serious a matter it is to have the orifice wear from $\frac{3}{8}$ in. to $\frac{1}{16}$ in., at 60 lb. pressure, can be found in the accompanying table. The flow of air increases from 151

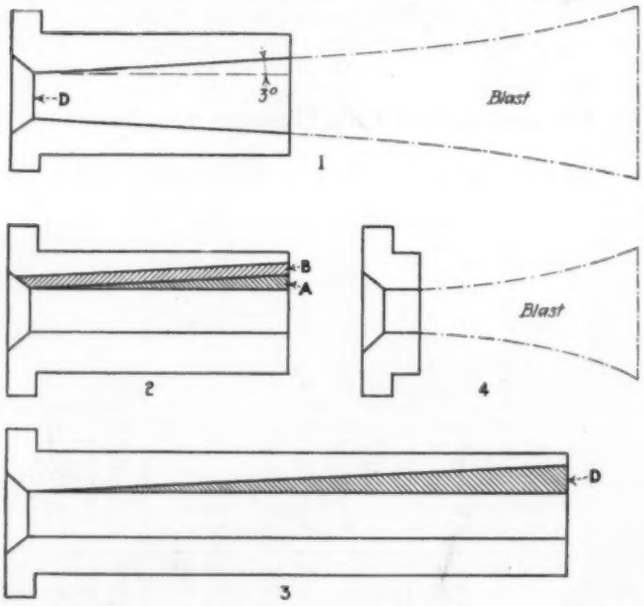
Operating Costs in Cents with Varying Orifices, Pressures, and Unit Charges for Power

Gage Pressure	Nozzle	Air Cu.Ft. Min.	1.5		2.0		2.5		3.0		3.5		4.0		Kw. per Cu.Ft. Free Air Per Min.
			Per Hr.	Per 1,000	Per Hr.	Per 1,000	Per Hr.	Per 1,000	Per Hr.	Per 1,000	Per Hr.	Per 1,000	Per Hr.	Per 1,000	
30	$\frac{3}{16}$	22.4	2.82	2.10	3.75	2.80	4.70	3.50	5.63	4.20	6.60	4.90	7.50	5.60	0.09
	$\frac{1}{4}$	40.0	5.04	2.10	6.72	2.80	8.40	3.50	10.0	4.20	11.7	4.90	13.4	5.60	
	$\frac{5}{16}$	62.5	7.90	2.10	10.5	2.80	13.2	3.50	15.8	4.20	18.4	4.90	21.0	5.60	
	$\frac{3}{8}$	90.0	11.3	2.10	15.2	2.80	19.0	3.50	22.7	4.20	26.5	4.90	30.3	5.60	
	$\frac{7}{16}$	123.0	15.4	2.10	20.6	2.80	25.7	3.50	31.0	4.20	36.0	4.90	41.1	5.60	
	$\frac{1}{2}$	161	20.4	2.10	27.2	2.80	34.0	3.50	40.8	4.20	47.5	4.90	54.4	5.60	
35	$\frac{3}{16}$	25.0	3.70	2.46	4.93	3.28	6.16	4.10	7.40	4.92	8.60	5.74	9.84	6.56	0.10
	$\frac{1}{4}$	44.7	6.67	2.46	8.90	3.28	11.1	4.10	13.3	4.92	15.5	5.74	17.8	6.56	
	$\frac{5}{16}$	69.8	10.3	2.46	13.8	3.28	17.2	4.10	20.6	4.92	24.0	5.74	27.5	6.56	
	$\frac{3}{8}$	100	14.8	2.46	19.7	3.28	24.6	4.10	29.5	4.92	34.5	5.74	39.4	6.56	
	$\frac{7}{16}$	136	20.1	2.46	26.8	3.28	33.5	4.10	40.2	4.92	46.9	5.74	53.6	6.56	
	$\frac{1}{2}$	179	26.4	2.46	35.2	3.28	44.0	4.10	52.9	4.92	61.6	5.74	70.4	6.56	
40	$\frac{3}{16}$	27.4	4.50	2.73	6.02	3.64	7.53	4.55	9.03	5.46	10.5	6.37	12.0	7.28	0.11
	$\frac{1}{4}$	49.1	8.00	2.73	10.7	3.64	13.4	4.55	16.0	5.46	18.7	6.37	21.5	7.28	
	$\frac{5}{16}$	78	12.8	2.73	17.1	3.64	21.4	4.55	25.7	5.46	30.0	6.37	34.2	7.28	
	$\frac{3}{8}$	110	18.2	2.73	24.3	3.64	30.3	4.55	36.4	5.46	42.4	6.37	48.6	7.28	
	$\frac{7}{16}$	150	24.7	2.73	33.0	3.64	41.2	4.55	49.4	5.46	57.7	6.37	65.8	7.28	
	$\frac{1}{2}$	196	32.6	2.73	43.5	3.64	54.3	4.55	65.2	5.46	76.2	6.37	87.0	7.28	
45	$\frac{3}{16}$	30.4	5.26	2.92	7.02	3.90	8.80	4.87	10.5	5.85	12.3	6.82	14.1	7.80	0.118
	$\frac{1}{4}$	53.8	9.4	2.92	12.6	3.90	15.7	4.87	18.8	5.85	22.0	6.82	25.1	7.80	
	$\frac{5}{16}$	84.1	14.8	2.92	19.7	3.90	24.6	4.87	29.6	5.85	34.5	6.82	39.4	7.80	
	$\frac{3}{8}$	121	21.1	2.92	28.2	3.90	35.1	4.87	42.2	5.85	49.3	6.82	56.1	7.80	
	$\frac{7}{16}$	164	28.8	2.92	38.4	3.90	48.0	4.87	57.6	5.85	67.2	6.82	76.8	7.80	
	$\frac{1}{2}$	215	37.6	2.92	50.2	3.90	62.8	4.87	75.1	5.85	87.8	6.82	100.1	7.80	
50	$\frac{3}{16}$	32.8	6.24	3.16	8.32	4.22	10.4	5.27	12.5	6.33	14.6	7.38	16.6	8.44	0.127
	$\frac{1}{4}$	58.2	11.0	3.16	14.7	4.22	18.4	5.27	22.1	6.33	25.8	7.38	29.5	8.44	
	$\frac{5}{16}$	91	17.3	3.16	23.0	4.22	28.8	5.27	34.6	6.33	40.3	7.38	46.2	8.44	
	$\frac{3}{8}$	130	24.7	3.16	33.0	4.22	41.2	5.27	49.4	6.33	57.7	7.38	66.0	8.44	
	$\frac{7}{16}$	177	33.7	3.16	44.9	4.22	56.2	5.27	67.4	6.33	78.6	7.38	89.8	8.44	
	$\frac{1}{2}$	232	44.1	3.16	58.8	4.22	73.5	5.27	88.2	6.33	103.0	7.38	117.7	8.44	
60	$\frac{3}{16}$	37.5	7.97	3.54	10.6	4.72	13.3	5.90	15.9	7.08	18.6	8.26	21.2	9.44	0.143
	$\frac{1}{4}$	67	14.2	3.54	19.0	4.72	23.7	5.90	28.5	7.08	33.2	8.26	37.9	9.44	
	$\frac{5}{16}$	105	22.3	3.54	29.8	4.72	37.2	5.90	44.7	7.08	52.1	8.26	59.6	9.44	
	$\frac{3}{8}$	151	32.1	3.54	42.8	4.72	53.4	5.90	64.2	7.08	74.8	8.26	85.7	9.44	
	$\frac{7}{16}$	205	43.6	3.54	58.2	4.72	72.7	5.90	87.3	7.08	101.5	8.26	116.2	9.44	
	$\frac{1}{2}$	268	56.8	3.54	75.8	4.72	94.8	5.90	113.7	7.08	132.7	8.26	151.6	9.44	
70	$\frac{3}{16}$	42.9	10.0	3.90	13.3	5.20	16.7	6.50	20.0	7.80	23.4	9.10	26.8	10.4	0.157
	$\frac{1}{4}$	76	17.7	3.90	23.6	5.20	29.6	6.50	35.4	7.80	41.4	9.10	47.3	10.4	
	$\frac{5}{16}$	119	27.8	3.90	37.0	5.20	46.3	6.50	55.6	7.80	64.8	9.10	74.2	10.4	
	$\frac{3}{8}$	171	39.9	3.90	53.2	5.20	66.6	6.50	79.8	7.80	93.2	9.10	106.4	10.4	
	$\frac{7}{16}$	233	54.4	3.90	72.7	5.20	90.8	6.50	109.0	7.80	127.1	9.10	145.2	10.4	
	$\frac{1}{2}$	304	71.1	3.90	94.8	5.20	118.2	6.50	141.9	7.80	165.5	9.10	189.2	10.4	
80	$\frac{3}{16}$	47.5	12.1	4.23	16.2	5.64	20.3	7.05	24.3	8.46	28.4	9.87	32.4	11.28	0.17
	$\frac{1}{4}$	85	21.6	4.23	28.8	5.64	36.0	7.05	43.2	8.46	50.4	9.87	57.6	11.28	
	$\frac{5}{16}$	153	33.8	4.23	45.1	5.64	56.3	7.05	67.6	8.46	78.8	9.87	90.2	11.28	
	$\frac{3}{8}$	191	48.5	4.23	64.7	5.64	80.8	7.05	97.0	8.46	113.0	9.87	129.2	11.28	
	$\frac{7}{16}$	260	66.1	4.23	88.2	5.64	110.0	7.05	132.1	8.46	154.1	9.87	176.1	11.28	
	$\frac{1}{2}$	340	86.3	4.23	115.0	5.64	144.0	7.05	173.0	8.46	201.0	9.87	230.0	11.28	

to 205 cu.ft. in this case, which at 2c. per kw.-hr., would increase the cost of operation just 36 per cent.

A peculiar characteristic of the effect of abrasion is that, while within the confines of the nozzle, the contour of wear is very nearly three degrees. The entrance, or orifice, which becomes the apex of the angle does not begin to show enlargement until after the three degrees have been reached as in Fig. 2 area *A*. Area *B* is an indication of what takes place after the three degrees have been cut away by the abrasion of the blast.

Maximum efficiency is not obtained until area *A* has been removed, but better economy is obtained in working with a slightly less efficient nozzle than by immediately enlarging the entrance orifice and consequently



Figs. 1-4—Diagrams illustrating wear due to abrasion

increasing the cost of air. An extreme case of nozzle saving is shown in Fig. 3 where the area *A* is larger than in Fig. 1. The nozzle will be more serviceable in an approximate direct proportion to the greater amount of metal to be internally removed to the 3-deg. angle.

The resistance of flow through a long nozzle of this kind is excessive and consequently the striking of the projectile on the work to be cleaned is lighter.

Another extreme case is shown in Fig. 4. Here the nozzle will wear out less rapidly and the maximum efficiency can be held for a long period. The diverging of the blast, however, spreads the abrasive too much for effective cleaning unless operated at close range, which does not give best results for hard burned work because the blast has not reached its maximum velocity.

For work having large areas easy to clean, the spreading nozzle will do very well. The nozzle orifice can be made larger and the air pressure reduced, resulting in more abrasive flowing at less cost.

High pressure, over 60 lb., should not be used for soft abrasives, such as the cheaper sands, because the loss from breakage of the grains and the amount of dust will be excessive. Flint sands and metallic abrasives are more suitable for pressures from 60 to 80 lb. For deep-cored steel castings and forgings the hard abrasives and high pressures are most economical.

The table is based on air discharging through varying sizes of orifices with no abrasive flowing. From tests made it was found that approximately 30 per cent less air is discharged with mineral abrasive and about 16 per cent less air when metallic abrasive is used.

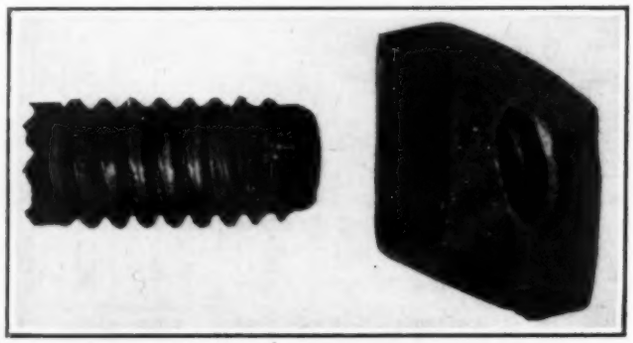
This reduction in air consumed is easily offset by leakage in the system, and has, therefore, not been deducted in the calculations. Two-stage compression will also show a saving of 10 to 15 per cent that has not been taken into account, thus putting the costs shown on the high side where they may be taken as safe figures for the average installation.

An Early Example of Rolled Threads

BY S. J. BERARD

Some years ago, while passing an old dwelling house which was being demolished to make more campus area for the Sheffield Scientific School at New Haven, the writer picked up the odd looking bolt and nut shown in the accompanying photograph. It is 16 in. long, T-headed, the body is ½ in. square, and the end is threaded a distance of 1 inch.

The building was at least 100 years old, and, as the bolts were found on the original beams, it is quite evident that they were made about the same time the building was erected. The photograph shows clearly the characteristic feature of a rolled thread in that the metal from the blank is displaced to form the crests which are quite imperfect on the threads of the bolt.



Made more than a hundred years ago

The question naturally arises as to how the threading was done, as there were certainly no machines available. As it is hardly possible that the thread was formed on the cold metal, the writer's conjecture is that after the end to be threaded was forged cylindrical, it was reheated, and a special triangular shaped former with rounded edge was applied to form the root, being held at a suitable helix angle. The metal was displaced either by a rapid succession of hammer blows on the former as the bolt was slowly turned, or a heavy weight or force was applied to the former which was moved over the bolt in the direction of the helix.

The nut is rectangular, very crude and evidently made from a flat wrought-iron bar, the threading conforming to that of the bolt, although somewhat irregular. Here again it is possible that the threading was accomplished by heating the blank nut and using the bolt as a tap, since the nut shows considerable distortion. Perhaps some reader may be able to throw light on the early history of thread forming or can suggest some other methods, than the above, for the making of what is, without doubt, an interesting example of an early New England product.

Maintenance of Rolling Stock on New England Railroads

By Ellsworth Sheldon
New England Editor, *American Machinist*

The Maine Central railroad shops at Waterville, Maine —Fully equipped to handle classified repairs on the largest locomotives—Road has several Mallet compounds

THE MAINE CENTRAL is the larger of the two exclusively Maine railroads. It covers the southern half of the state and has branches extending into New Brunswick on the east, New Hampshire and Vermont on the west, and northward through the White Mountain region of New Hampshire into the Province of Quebec. Its principal shops, located at Waterville, Maine, are fully equipped to handle classified repairs upon the largest locomotives, including the several Mallet compounds that are in service on its mountain division.

The blacksmith shop is capable of turning out the largest forgings required upon an engine if need be, the boiler shop has all the necessary machinery to build locomotive boilers, and in the car shops every detail entering into the repair and maintenance of the various classes of cars used upon its tracks is provided for.

The locomotive and car shops are placed end to end with tracks running across the buildings, and all tracks of both shops are served by a single transfer table the pit of which extends over the combined length of the buildings. The boiler shop and wood-working mill are across the pit from these shops and are served by the same transfer table.

The outer walls of the locomotive shop are of two-story height with windows in all sides of the upper part, thus giving ample daylight upon the erecting floor. The floor is served by a 35-ton Niles bridge crane. An open bay extending from the side of the building opposite to the transfer table houses most of the machine tools, which are thus readily accessible from the erecting floor, and this part of the shop is served by smaller electric cranes operated from the floor.

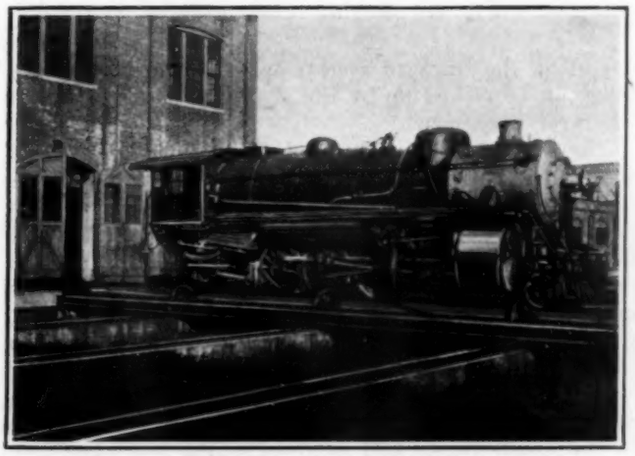


Fig. 1—Locomotive on transfer table

The machine tool equipment includes some old tools that have been in service since the early days of the road, and many that may be classed among the most modern type. On some of the older machines may be seen the names of Wood & Light, Bement-Miles, L. W. Pond and other builders of a generation or so ago, while among the later machines are Cincinnati millers, Bullard vertical turret lathes, Niles-Bement-Pond planers and boring mills and similar up-to-date tools of standard makes.

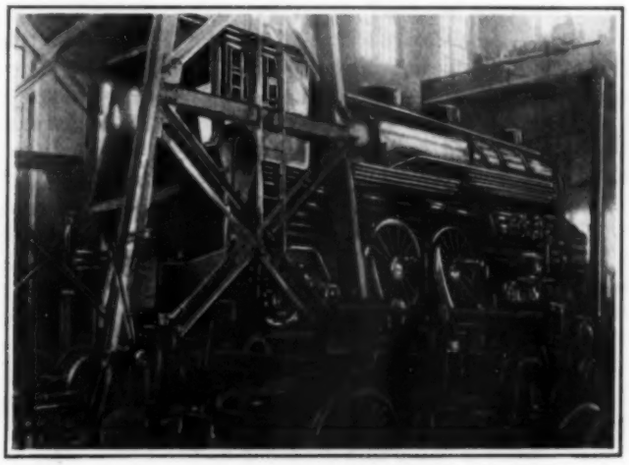


Fig. 2—Gantry cranes for hoisting the locomotives

The space between the buildings occupied by the car and locomotive shops respectively is closed in and provides a shop for the car-wheel and axle machinery, a room for the tanks in which the smaller parts of the engines are cleaned, and a casting room in which all the soft metal bearings for the cars are poured. The babbitt is melted in a large pot furnace and taken from it by hand ladles for pouring.

Beyond the machine shop bay are separate buildings in one of which is the blacksmith shop and in the other the sheet metal shop and the air-brake department.

The blacksmith shop is provided with steam hammers, bulldozers, jib cranes and other machinery that render it capable of handling the largest forgings

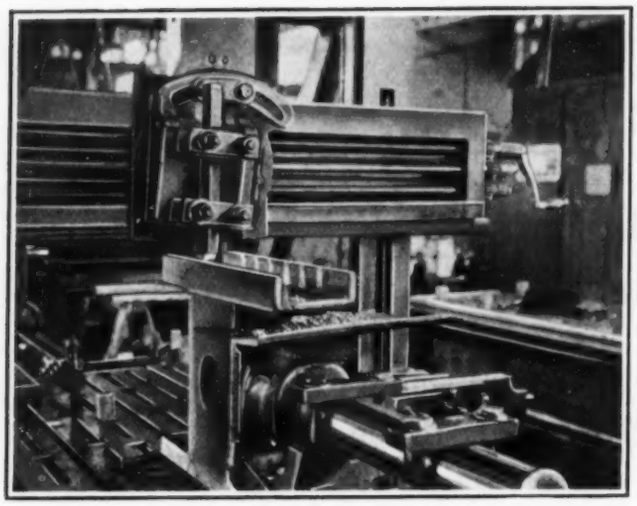


Fig. 3—Replaning a cross-head.

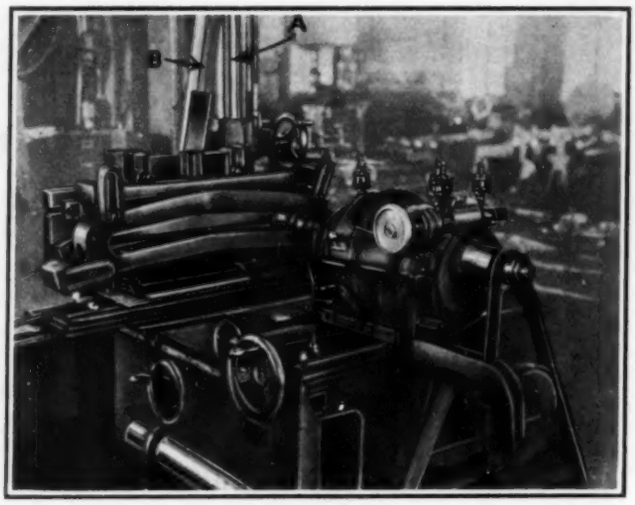


Fig. 5—Grinding hardened links

upon a locomotive. All of the smaller forged parts are regularly made here, and when an emergency makes it necessary—as when a main or side rod or other large forging is needed at once and prompt delivery from remote points cannot be secured—the larger ones can be turned out. Billets up to 8x16 in. by 8 ft. are kept in stock for this purpose.

Discarded car axles furnish the greater part of the supply of raw material for the smaller forgings. They are of excellent stock and can easily be drawn out to any required shape under one of the steam hammers. By using up old axles the department is able to save the difference between the scrap value of the axles and the price of new stock, besides the double haulage that would otherwise be necessary.

A part of the blacksmith shop is given over to the manufacture of the many bolts and nuts of all sizes that are in constant demand in the car and locomotive shops. Power hammers, bolt headers, swaging machines and all other necessary equipment is provided for the work. Coal fires are used in the blacksmith shop and oil-fired furnaces in the bolt shop.

The transfer table and a corner of the boiler shop is shown in Fig. 1. The table is operated by electric motors, current for which is taken from trolley wires bracketed to the concrete supports of the intermediate rails. The mechanism includes winches for hauling engines into and out of the shops by means of wire cables and sheaves.

A locomotive to be overhauled is delivered to the first track of the erecting floor, where it runs under a pair of gantry cranes that are traversible along a wider track spanning the standard gage track upon which the engine stands, so that engines of different lengths may be accommodated. The smaller parts are stripped off and sent to the wash room to be cleaned and the engine is then lifted by means of the cranes, which are operated by independent electric motors, and the wheels rolled

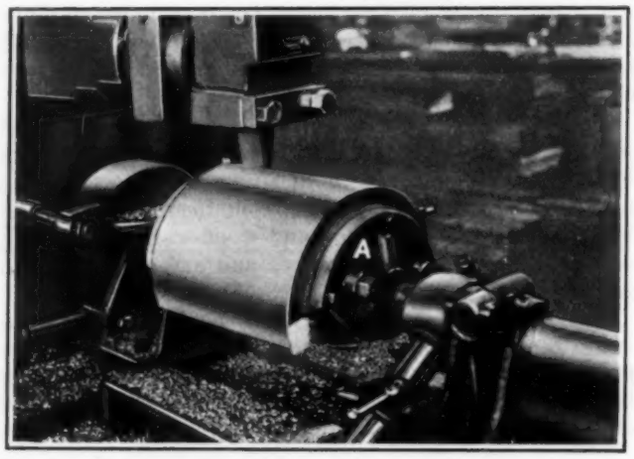


Fig. 6—Shaping crown brasses

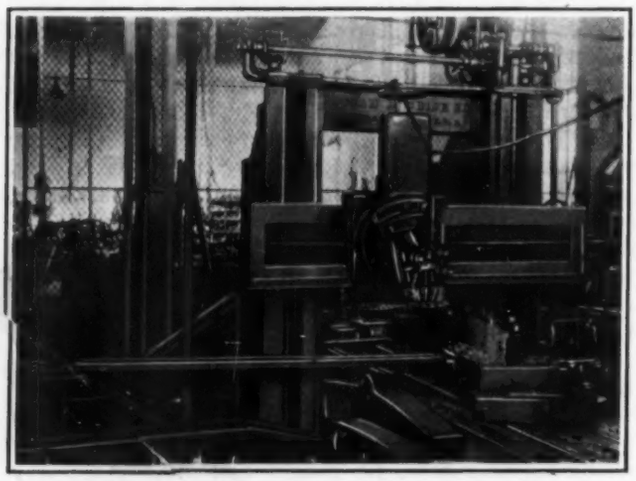


Fig. 4—Radius planing device for links

out along the track to a clear space in the rear where they can be picked up by the shop crane and delivered wherever necessary.

The engine is then lowered upon dolly trucks and shifted by means of the transfer table to any track that may be available. Fig. 2 shows an engine suspended from the gantry cranes for a minor repair that involves the removal of the forward pair of drivers only. The driving-wheel lathe, wheel press and other machines and appliances for handling driving-wheel, tire and axle work are located at this end of the shop to avoid needless transportation of heavy parts.

The planers are located about midway of the length of the machine bay where they are convenient of access to the repair tracks and adjacent to the tool room. In Fig. 3 is shown a crosshead mounted upon a stub-end

rod that is held in V-blocks so that the slippers may be planed parallel to the bore.

A device for planing links and blocks is shown in Fig. 4. The part of the device that is mounted on the planer table consists of three pieces, the lower one bolted to the table and having at the center a short vertical stud upon which the intermediate part swivels. The upper part, to which the work to be planed is clamped by means of bolts and straps, is gibbed to slide crosswise of the intermediate part. To the upper part is fastened a radius arm that extends outward to a fulcrum pin carried by a bracket attached to the side of the planer bed. This fulcrum pin is adjustable along the bracket and radius arm to accommodate the device to different radii.

A Gisholt grinding machine with radius grinding attachment, shown in Fig. 5, is used to grind hardened

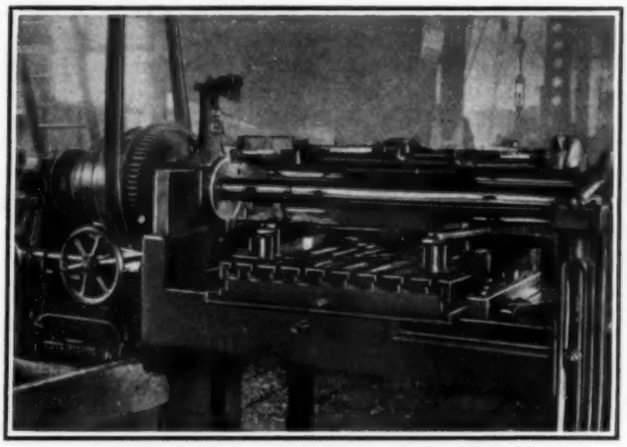


Fig. 7—Boring Cole extension driving boxes

links and blocks. In this machine the part to be ground is clamped to the side of a plate that is gibbed to slide vertically in a fixture mounted on the traversing table of the machine. A post *A* extends upward from the machine bed, and upon it is a vertically adjustable collar carrying the fulcrum pin upon which the radius arm *B* swings. This machine is of the universal type and by removing the radius attachement can be used for straight surface grinding. It has a double, adjustably-eccentric, spindle that adapts it to internal cylindrical grinding also.

In Fig. 6 may be seen a fixture for turning and planing the crown brasses preparatory to forcing them into the driving boxes. A brass is clamped by end pressure between the adjustable collar *A* and a fixed collar at the other end of the arbor. The spindle, or arbor, is rotatable by hand, like a pair of index centers, and is also provided with an automatic feed. The machine upon which it is used is a Morton draw-cut shaper. This fixture possesses an advantage over the usual method of turning the brasses in a lathe and afterward mounting them in a shaper or planer to plane the edges, in that the job is completed in one setting and there is no question as to its parallelism.

After the crown brasses have been forced into the driving boxes they are bored upon a Bullard vertical turret or similar machine. Some of the engines, however, are fitted with Cole extension boxes like that shown upon the Betts boring mill in Fig. 7, and these obviously require a different method of handling.

A portable boring outfit that is used to bore cylinders

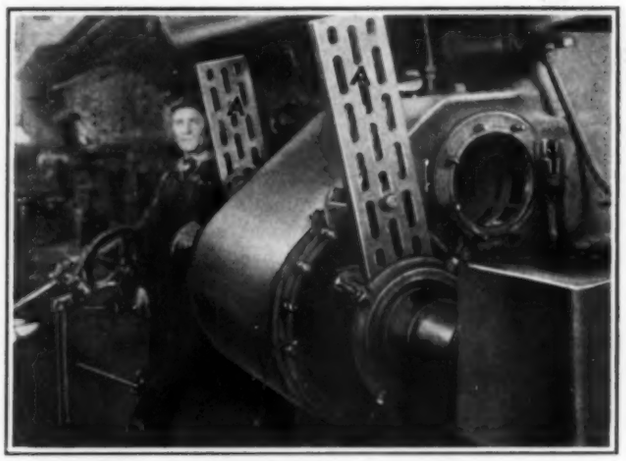


Fig. 8—Portable cylinder-boring rig

without dismounting them is shown in Fig. 8. It is adaptable to any diameter of cylinder likely to be encountered in locomotive work by merely changing the boring head. The slotted plates *A* are bolted to the cylinder by means of the stud-bolts that hold the cylinder heads when the engine is in service, and the bar is centered in the cylinder by tapping the plates one way or another before finally tightening the nuts on the stud bolts. The bar is ordinarily driven by an air-drill attached to the first member of the geared speed-reducing train and coupled by a hose to any convenient distributing pipe from the shop compressed air mains.

The outfit when not in use is packed in a stout wooden case having compartments for the bars, boring heads and each accessory part, and provided with straps so that it can be suspended from the hook of a crane. It is thus easily transportable about the shop, and when this case is set down by the side of a job the operator knows that he has every requisite ready to hand to complete the work. A great deal of time is saved in this way.

There is in this shop a small oscillating engine permanently mounted upon a heavy iron truck that can be wheeled to any point on the floor and used to supply power for cylinder boring rigs and other appliances that demand portability as a prime requisite in a power unit. This engine was built in the shop many

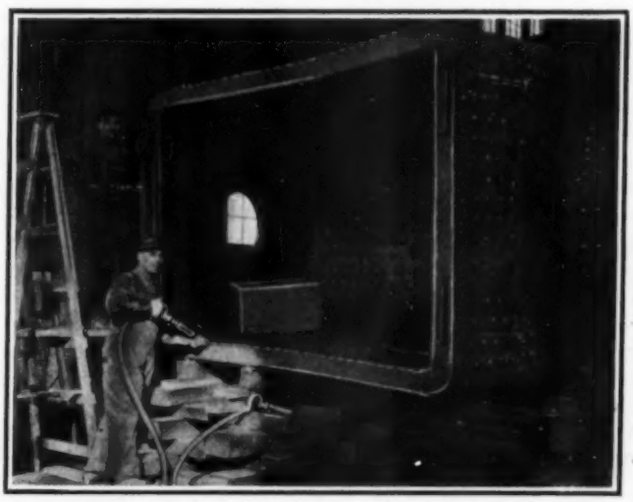


Fig. 9—Putting in a new fire-box

years ago, before electricity and compressed air were in common use as transmitters of power, and was, of course, intended to be run by steam. With the advent of the air-compressor and the distribution of air pressure throughout the shop it was found to be equally adaptable to air as a driving medium. The small electric motor and the high-speed rotary air motor have rather put this engine out of business and its services are seldom required, but it is in excellent running condition and could be put into operation at very short notice.

The boiler shop is equipped with punches, shears, bending rolls, etc., to handle the largest sized plates and is well supplied with acetylene torches, air hammers, electric drills and other small tools. Though the road does not attempt to build new boilers, it has all the machinery to do so upon occasion. Fig. 9 shows one of the largest locomotive boilers, to which an entire new fire-box has been fitted.

Where Do You Get Foremen?—Discussion

By C. G. Williams

ENTROPY occasionally gives us some dope to mull over and again he gives some of us a real chance to cuss. Both the editorial and Entropy's article under the title given above, on pages 820 and 978, Vol. 60, of the *American Machinist*, were read with interest.

I think the shop that made forty out of forty-two foremen from men in its own shop has a look in for a bankruptcy court, that is if these men were actually made in that shop and had never worked in any other. That shop will either have a good bunch of "ingrowing nails" or else it will have to bring in an extra good man to tool up the machines and route the work.

Entropy must have forgotten his days in the shop and how the general run of workers would rather swap yarns than study any course of foremanship that ever existed. There are at present two very good foremanship schools that are nearly starving to death, also two special correspondence-school courses for executives that will give about all that any man may wish to take up, if he will study them.

After Apprenticeship

If I were at the head of a large machine company, the best type of apprentice system that could be incorporated would be put to work and after the boys had finished their time, they would be told to get out and work for the other fellow for three years, then to come back and there would be a job for them. I am sure that only a few would come back and that it would not hurt the firm to find places for them. If they were worth their salt, they would be much better men for having been sent out to work for the other fellow and they would have picked up many things that might have passed by them if they had not gone out into the world to find them. Then I would get them to pass on any ideas they may have collected, by paying them well for every idea that could be accepted, and in that way build up initiative that might otherwise lie dormant.

I do not believe there are many owners, managers or superintendents who do not recognize the need of training for foremanship, but the trouble is that the men, and incidentally the foremen themselves, do not recognize the fact that they need such training.

I have in mind a large shop, or rather a series of shops welded into one big concern. The superintendent of one of the sections felt the need of training for the foremen under him. He also felt that the men should stand part of the cost of the course and the shop should stand the remainder. The agreement was that the shop should stand half of the cost of the course and that the foremen should pay for half in installments, but that the firm would reimburse every foreman for his half if he completed the course. Every foreman went into the course, but first one and another would miss one of the lectures, and shortly afterwards some of them dropped out entirely. This continued until only about twenty eight per cent of the foremen completed the course, and a small part of these could not pass the final examination. Some of the men went to the office and complained that they should not be made to pay for half of the course, since they had stopped studying because they did not feel the course was doing them one bit of good. It was explained to them that the firm had entered into the agreement in good faith and must pay the bill if the men did not, and that it was for the good of the men as well as the firm that the course had been undertaken, therefore, each foreman must pay his half unless he completed the course, when it would be refunded, but that no money would be refunded otherwise.

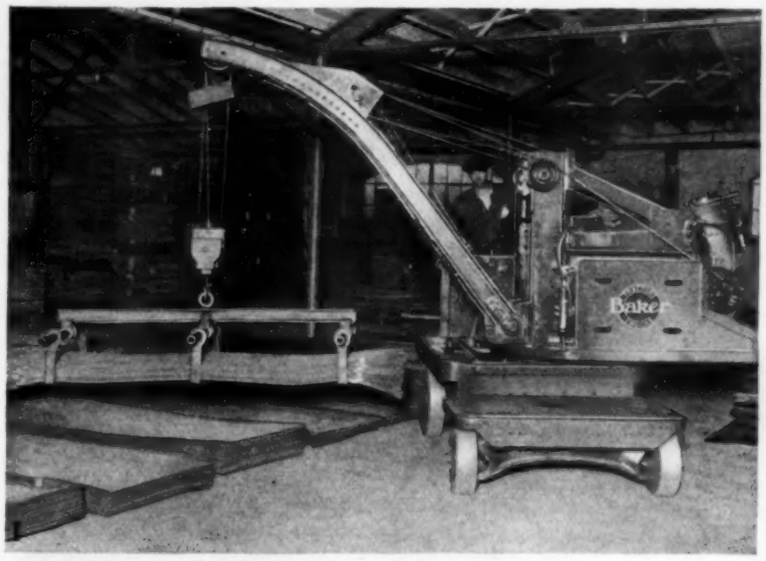
Teaching Prospective Foremen

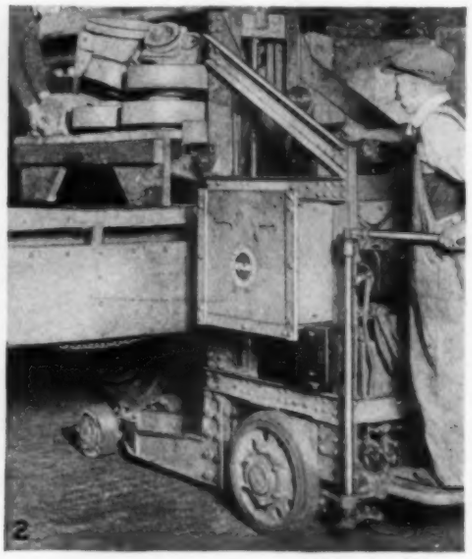
The actual facts of the case were that the men who had been considered as the poorest material for foremen, were those who recognized their own deficiency and tried to get more knowledge. With them the course was a necessity and, because they know that they could not hold their jobs without special and extra work, they studied hard to get the training necessary.

We do not need the courses in foremanship half as much as we need to instill into the minds of the workers that it is up to them to put more time and energy into their work, and into studying or reading along lines parallel with their work. We also need, and need badly, to have some reading course mapped out for the foreman and men. A bulletin board that will give the titles of good articles and where they are to be found should be placed in the shop. We ought also to have the one who has charge of this bulletin board make arrangements with publishers to furnish at wholesale rates, whatever magazines might be called for by the men. Then the men would have no complaint that they could not find the magazines containing the articles referred to on the bulletin board.

Increasing the Resistance to Wear of Gage Steel

The generation of internal stress in gage steel on quenching has been studied theoretically and experimentally on one type of steel by the Bureau of Standards. This has a bearing on the prevention of cracking of gages on quenching and on wear resistance. Wear resistance appears to increase with quenching temperature, in this type of steel, so that if means can be found to avoid cracking when a high quenching temperature is used, the wear should be decreased.





Power Trucks That Save Handling Time

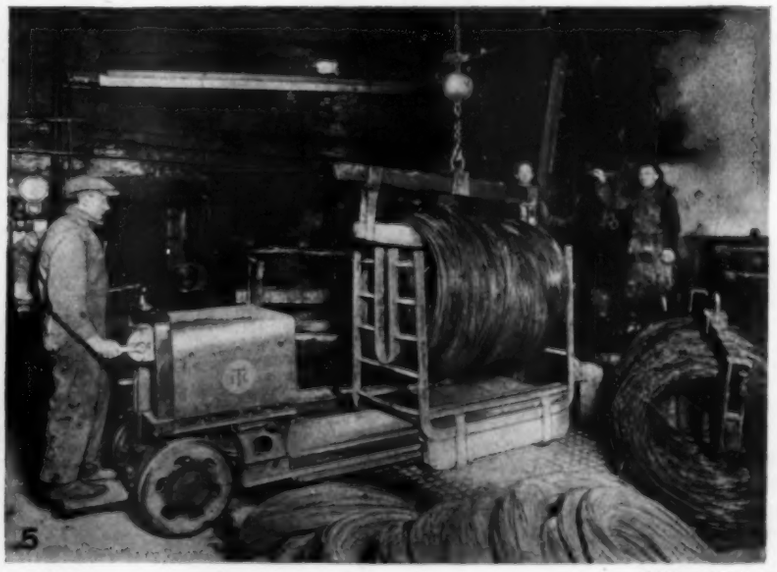
Fig. 1—Handling sheet steel with Baker crane truck

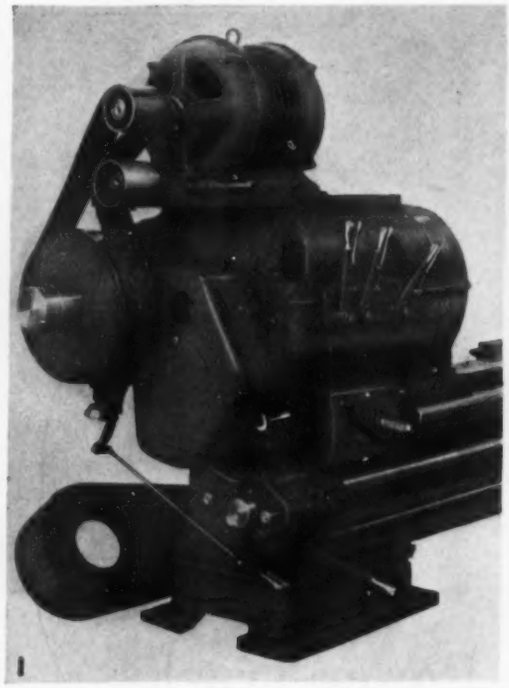
Fig. 2—Atlas hoist-truck loads castings into motor truck

Fig. 3—Tiering boxes of glass with a Baker crane-tractor truck

Fig. 4—Cowan power truck and load

Fig. 5—Handling coils of wire on a Cowan power truck





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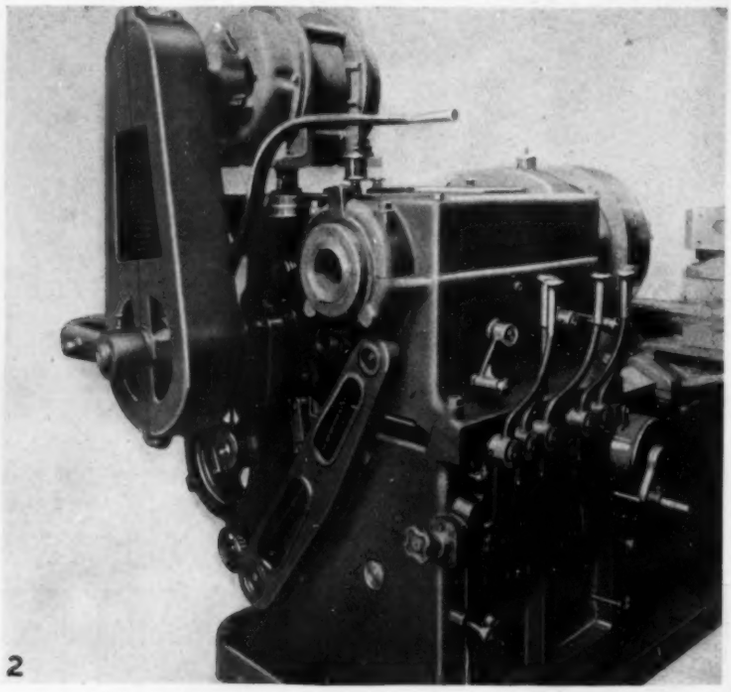

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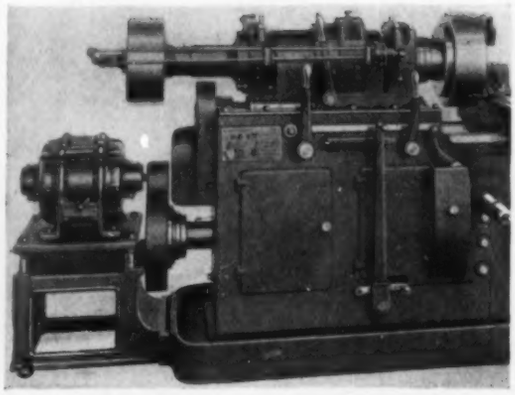
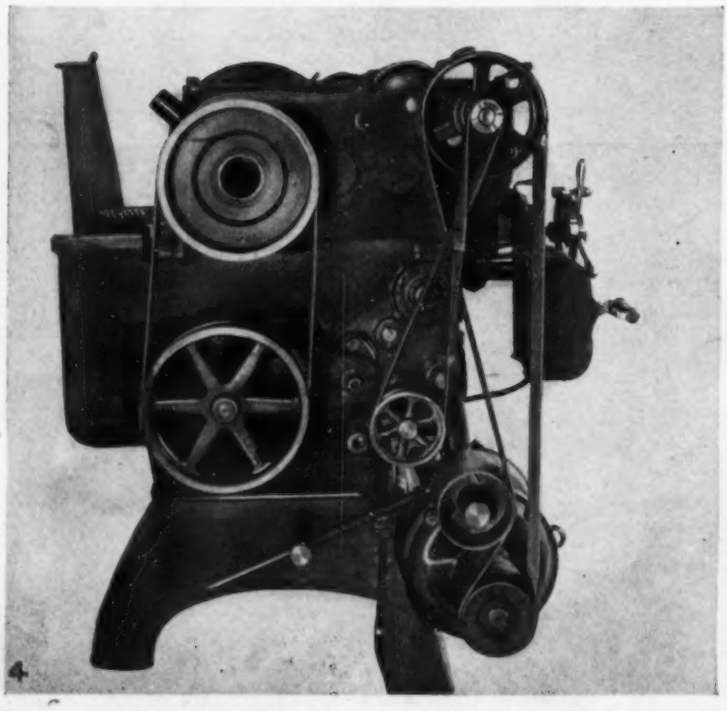


Modern Methods of Mounting Motors

Lathes

1—Lodge & Shipley—motor on head
2—Potter & Johnston—motor on head
3—Potter & Johnston—motor on separate base
4—Jones & Lamson—motor on front leg
5—Lodge & Shipley—motor in leg



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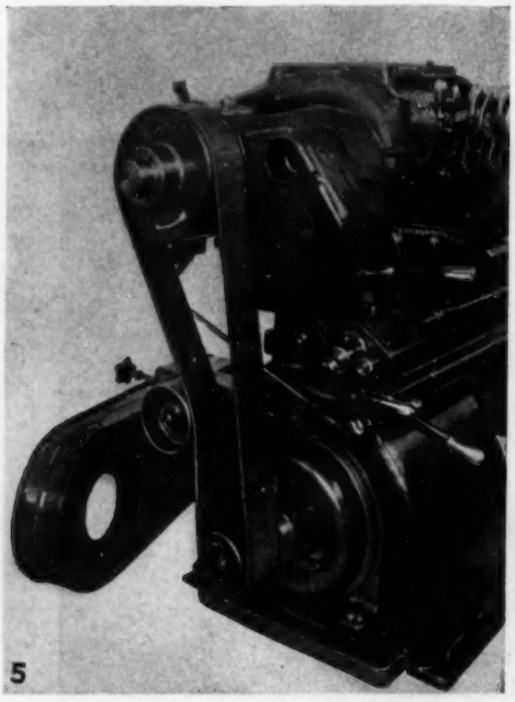

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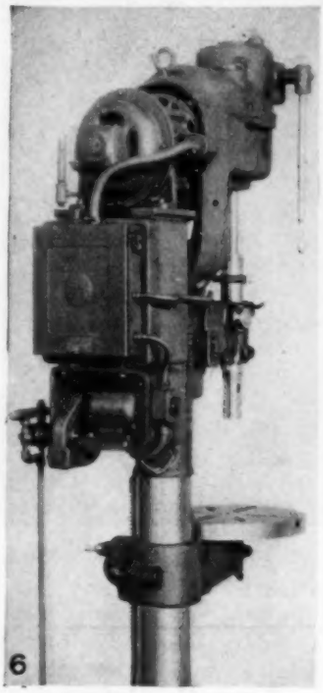
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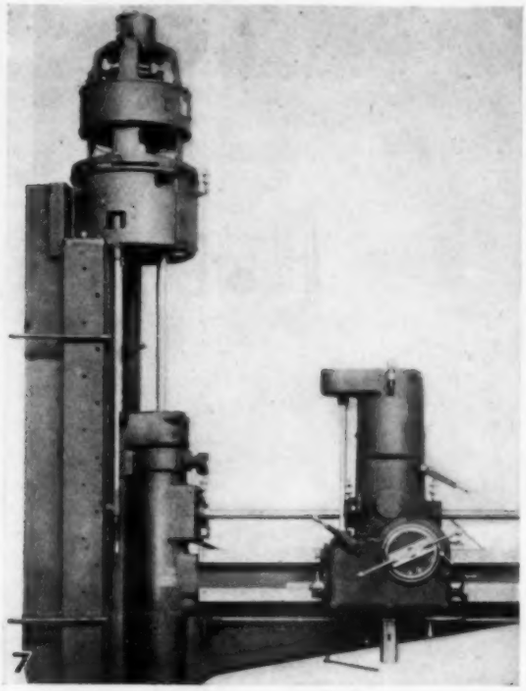
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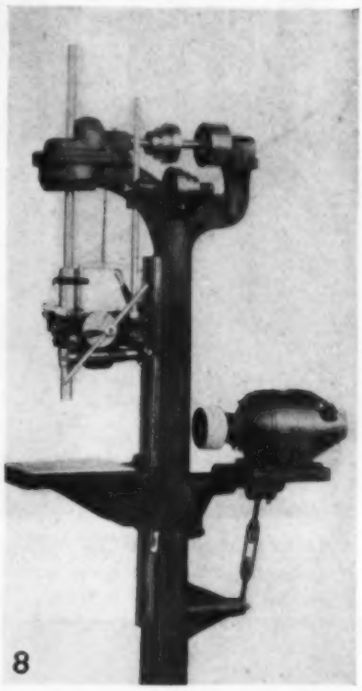
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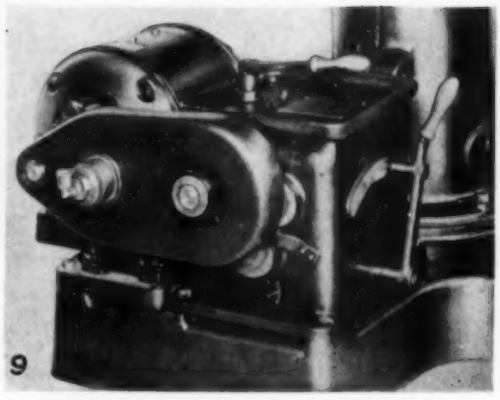
Drilling Machines

6—Cincinnati Bickford—motor at top
7—Cincinnati Bickford—wall type with vertical motor
8—Cincinnati Bickford—motor on swinging bracket
9—Morris Machine Co.—radial, motor on base
10—Hoefer special, oil-gear feed, motor inside frame
11—Minster Machine Co.—bronze pinion on motor-shaft drives internal gear on driving shaft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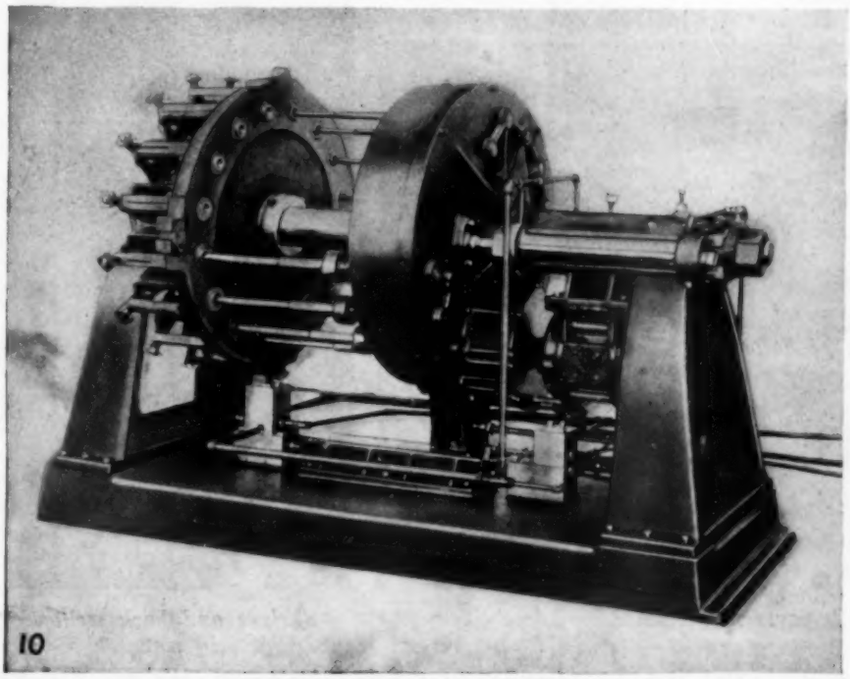
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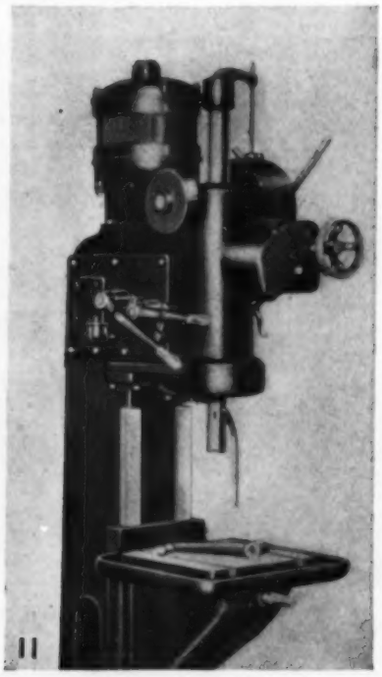
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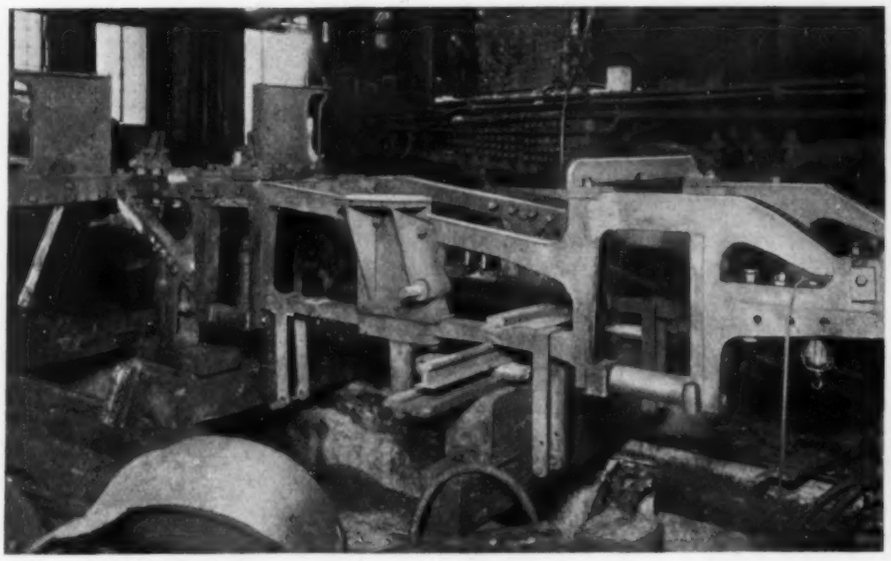
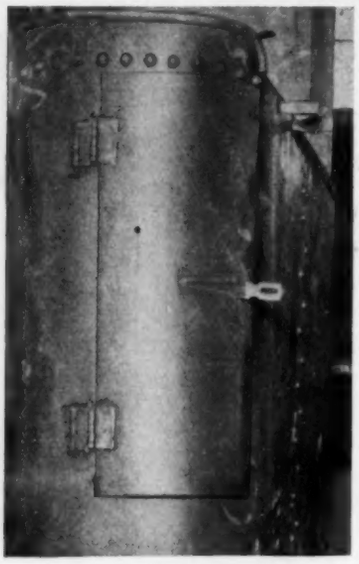


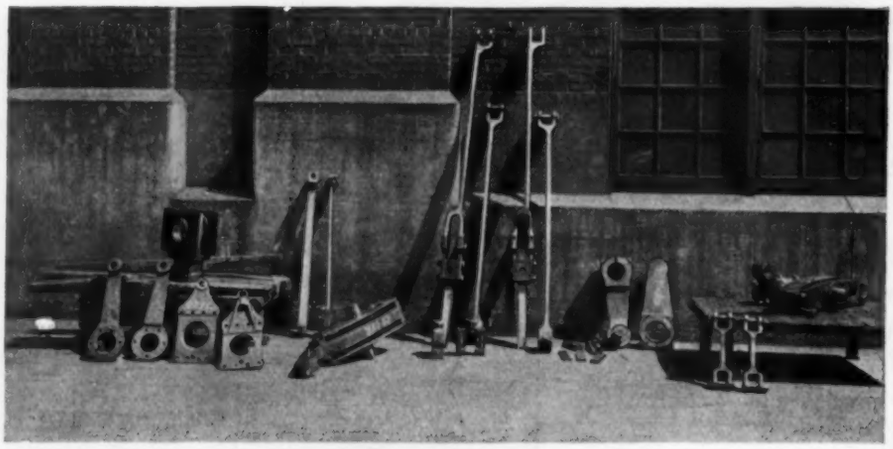
Frame stripped to be welded for wear



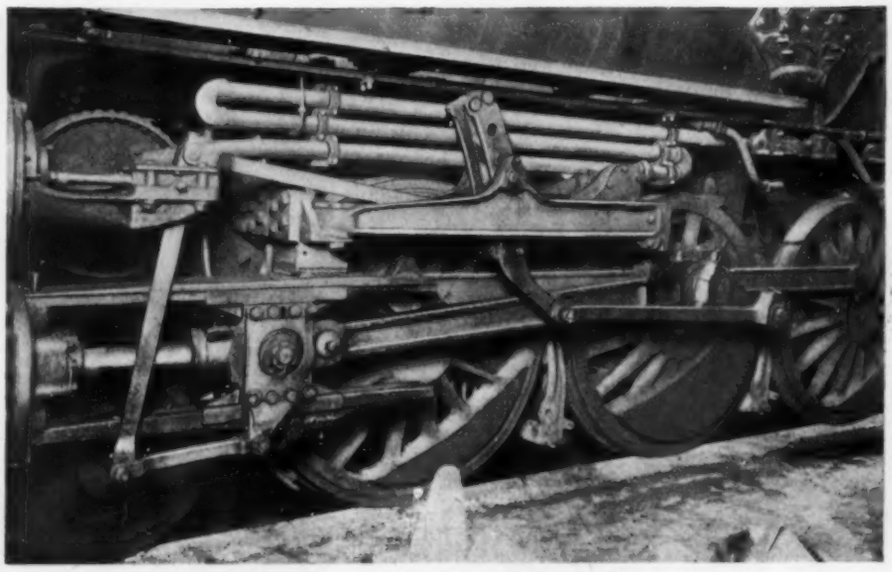
Door hung on tender toolbox without rivets

Arc Welder in a Railroad Shop

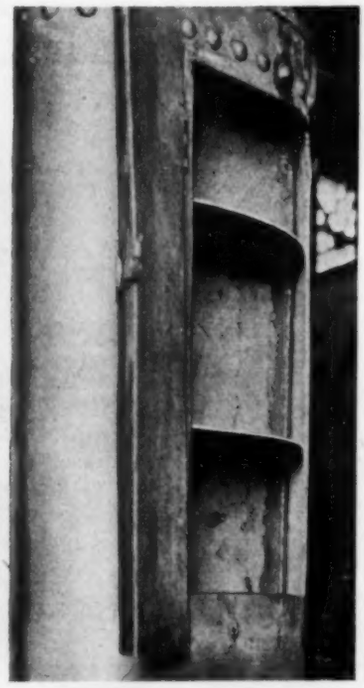
Photographs by courtesy of the General Electric Co.



Parts to be built up by welding



Locomotive with parts reassembled



Shelves and back welded in place

What May I Deduct in My Tax Return?

WHEN one is ready to file his income tax return there is always a strong feeling of doubt as to whether all the allowable deductions have been taken. This is partly due to the fact that individuals, as a rule, keep no records other than their check books, which, of course, do not show every allowable deduction.

Under the law, deductions are not limited to those disbursed in cash. Even corporations keeping books of account do not always deduct all the expenses and losses to which they are entitled.

In the case of many individuals, a large part of their so-called personal expenses are really incurred in connection with their business. If account were kept of these expenses, it would be found that at the end of the year a fair-sized sum had accumulated which could be used as a deduction from income. Among such expenses are those incurred in traveling, entertaining customers, dues to professional and trade organizations, and in general expenses that the taxpayer would not have to incur were he not engaged in business. This includes meals and lodging while traveling away from home on business, which is specifically mentioned as an allowable deduction in the law.

A deduction very often overlooked by individuals who do not keep accounts, and even by corporations that do keep accounts, is depreciation on buildings, machinery, fixtures and other equipment. The reason for this omission is that such loss is a gradual shrinkage which may not be evident even by inspection of the property and is, of course, not shown as a cash payment.

Nevertheless, the law recognizes that buildings and similar assets suffer a gradual wear and tear and obsolescence, and that they eventually become useless. The taxpayer, therefore, receives the benefit of this gradual loss in value as a deduction from his annual income. It should be noted that this depreciation allowance is limited to property used in business and cannot be taken on a man's home, or on his pleasure automobile. A change in the 1924 law which will be of material benefit to a great many taxpayers is that authorizing the deduction for depreciation to be based on the March 1, 1913, value, or the cost, whichever is the higher. Under the old law, the depreciation allowance had to be based on the 1913 value; this benefited taxpayers only when the 1913 value was greater than the cost, while under the new law the advantage is extended to taxpayers whose cost was greater than the 1913 value.

Deducting for Old Machinery

It often happens, particularly in connection with machinery, that while the life of the property, when it was purchased, was expected to be of a certain length, it is found before the expiration of such life that the property has become useless for the purpose for which it was purchased with the result that the property is scrapped or abandoned. In such case the value of the property that has not yet been depreciated may be taken as a loss in the year when such property is abandoned.

For example, if a taxpayer purchased a machine for $5,000, that had an expected life of ten years and deducted each year as depreciation $500, he could deduct in the sixth year, if it was found that the machine was useless, a loss of $2,500 instead of the annual depreciation of $500. Instances have been known of taxpayers who continued to take annual depreciation on abandoned property when, as a matter of fact, they could have taken a greater deduction in the year the property was abandoned.

In reserving for depreciation each year, the rate is to be based on the useful life of the property. The useful life must be differentiated from the physical life of the property. A machine may have a physical life of twenty years, but because of the nature of the industry, the technical developments in the trade, the use to which the property is put, or other factors, the useful life of the property may be only ten years. While at the end of ten years this property may still be on hand to be used, it is unprofitable to make use of it and it has to be replaced by a new and more modern type of machine. The life of the property in such a case instead of being twenty years is only ten years and the annual depreciation would be at the rate of 10 per cent a year, instead of 5 per cent a year based on the physical life. It should also be noted that in most cases the rate of depreciation established presupposes a normal usage during each year of its life. There are times when the property is operated under abnormal conditions because of inability to make repairs, or incompetence of employees. It is evident in such cases that the machine suffers more than normal depreciation and the rate for that year should be adjusted accordingly.

On Property Sales

When property is sold, the cost, or March 1, 1913, value, must be first reduced by the amount of depreciation previously allowed as a deduction on income tax returns. For example, if a taxpayer sells a building for $50,000 which cost him $40,000 in 1914, this cost must be reduced by the depreciation taken by the taxpayer on all of his returns since that date. If this depreciation amounts to, say $6,000, his profit will be $16,000, the difference between $50,000 selling price and depreciated cost of $34,000. If in the above illustration, the property had been acquired at a cost of $40,000 in 1900 and had a value in 1913 of $30,000, and there had been taken as a deduction on previous tax returns $6,000 depreciation, the profit would still be $16,000. On the other hand, if the property had on March 1, 1913, a value of $60,000 and the depreciation deducted on the returns between that date and the date of sale was $6,000, there would be a loss of $4,000, the difference between the $50,000 selling price and the $54,000 depreciated 1913 value.

The important point to notice in connection with the above examples is that not only may the 1913 value be used as a basis in computing profit and loss where it exceeds the cost, but that the basis need be reduced only by the depreciation previously allowed since March 1, 1913, or since the date the property was acquired, if acquired after that date. Hitherto, the Treasury Department reduced the basis by the full depreciation accrued up to the date of sale regardless of whether or not it had been taken as a deduction on any tax returns.

Under a new provision in the 1924 law, the taxpayer may have to use as a basis for computation of depre-

From an article prepared by Leslie Banks & Co., auditors and accountants, 50 Church St., New York City.

ciation and profit, or loss, not his own cost of the property, but the cost of the property to the predecessor owner. This rule would apply, for example, to a case where a corporation acquired the property by the issuance of its stock in a type of exchange or reorganization where the predecessor owner of the property did not have to report a profit on the transaction.

Taxpayers who reside abroad, or who have income from foreign sources, may have had occasion to pay an income or profits tax to a foreign country. Such taxes in certain cases, are deductible from the United States income tax. This, of course, is a much greater benefit to the taxpayer than if the taxes were deductible merely from the gross income. Every taxpayer who has had occasion to pay any foreign taxes should determine whether or not they represent income or profits taxes, and whether they may be taken as a deduction from his United States income tax. If they are not deductible from the United States income tax, they are deductible from the gross income.

Taxpayers have been cautioned so long that Federal income taxes are not a deduction in computing their net income that many are still found who believe that this rule covers State income taxes as well. It is, therefore, not out of place at this point to mention that the income taxes paid to New York State are an allowable deduction in computing the income on the Federal return.

Doubtful bad debts are not deductible and the deduction may be taken only when the debt is finally determined to be bad. When a part of a debt is determined to be bad, that part may be deducted; but this is not allowable where the taxpayer is merely of the general opinion that he will not collect all of the debt. There must be something tangible to show that he will collect only part of the debt, as where he is advised by a trustee in bankruptcy as to the amount he will realize in the case of a debt due from a bankrupt.

Since the 1921 law was enacted, taxpayers have had the choice of reporting their bad debts as they occur or setting up annually a reserve for bad debts. In many lines of business, there is a distinct advantage in setting up a reserve for bad debts instead of deducting the bad debts as they occur. Taxpayers who believe it advisable to deduct a reserve for bad debts and who have not as yet adopted this practice on their tax returns, will require the permission of the Commissioner of Internal Revenue.

Saws and Safety

A report of the work of the safety department of Henry Disston & Sons, Inc., Philadelphia, Pa., shows some interesting points on the progress made in accident prevention during the nine years that the department has been organized. It reads in part as follows:

"On an average of nearly 3,000 men employed in our plant last year, only 71 men suffered time-losing accidents of a day or more. This compares with 300 men losing time due to accidents in 1916 when we started our campaign. The 71 men who have met with accidents in 1924 lost a total of 1,174 days, whereas in 1916, 5,471 days were lost."

This represents reductions of 76.3 per cent in the number of accidents, 78.5 per cent in the number of days lost, 73 per cent in the frequency rate and 75.5 per cent in the severity rate.

Over 340 suggestions were made and considered in 1924 in the three plants of the company and, of these, 334 were approved and over 300 executed. One of the direct results has been a substantial reduction in the insurance premium rate.

To quote the report: "The reduction of our average premium as compared with 1923 was 10c. per $100—from 52c. to 42c.—or nearly 20 per cent in one year alone.

"In regard to our three individual companies, the manual rate established in the State of Pennsylvania for steel manufacture of our character is $1.20 for each $100 in wages paid. Our rate this year is 66c. The manual for saw and file manufacture is 65c. Our rate is 36 cents."

It is estimated that a saving of $75,000 is represented in the premium difference alone in the past nine years aside from all other benefits that have accrued to the company and its employees.

Accidents on Foot-Power Machines

By Herbert L. Reid

Safety Inspector New York State Department of Labor

Although it is the general opinion that it is not necessary to provide guards for the point of contact on machines that are actuated by foot power, nevertheless there are many accidents that occur on this type of machine.

Often it is a simple matter to provide guards that would prevent many of these accidents and where it is not practicable to guard the machine the employees should be instructed in the proper and safe method of placing the stock on or feeding it into the machine.

Three such accidents were recently investigated that occurred on machines used for cutting the miter on moldings for house trim or for making picture frames. These accidents could have been prevented had an adjustable guard been placed on the outside of the cutting knives so that when the stock is held in position or adjusted under the knives, the fingers of the operator would rest against this guard preventing them from slipping under the knives.

Two accidents were investigated that occurred on foot-power metal-cutting shears. In one case the metal being cut was in a roll placed back of the shears. The metal was drawn under the knife and held against the gage on the table of the machine. The metal strip slipped out of the operator's hand and in trying to catch it, his hand went under the knife and at the same time he pushed down on the treadle with his foot cutting off the ends of two fingers.

The other accident happened when the operator was cutting sheets of tin into strips holding the metal against the gage at the back of the shears. While making the last cut on one sheet, the piece slipped and his finger went under the knife and at the same time he pushed down on the foot treadle cutting off the end of his finger.

One of the men in this factory said he had seen three such accidents occur in succession to three different operators.

These accidents could have been prevented if an iron bar had been attached to the shears in front of the knife with a space of about ¼ in. between bottom of bar and top of bed or table of shears.

The operator should also remove his foot from the treadle while adjusting the stock under the knives.

Ideas from Practical Men

The department, "Ideas from Practical Men" is devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

A Planing and a Milling Fixture for the Same Kind of Work

By K. S. Johnson

The work for which the fixtures shown in the illustrations were designed, consists of finishing three sides of steam cylinders for Worthington low-pressure pumps. They are respectively the right and the left cylinders, and the surfaces to be machined to the same dimensions

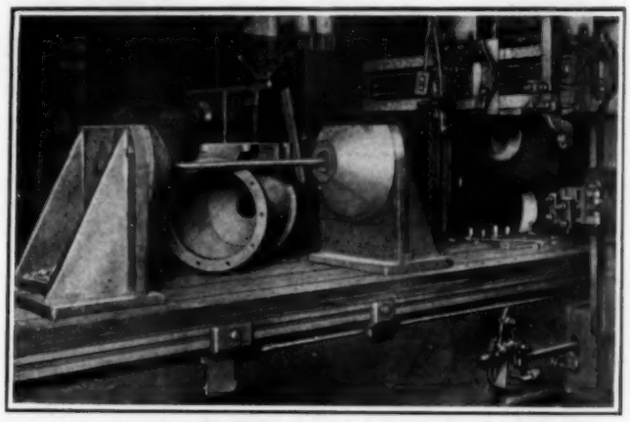


Fig. 1—Fixture for planing cylinders

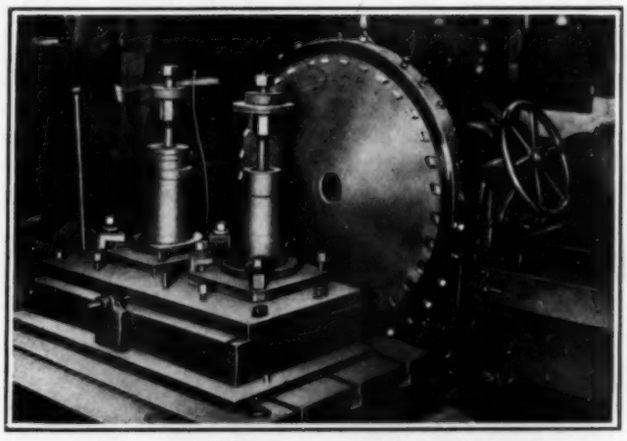


Fig. 2—Fixture for milling cylinders

are: the pad, the exhaust flange and the steam chest. One of the cylinders is shown in Fig. 1 on the planer.

The cylinders are clamped together in tandem and are centered by two cone-shaped brackets. A long rod is passed through both cylinders and the brackets, thus holding the whole arrangement tightly together. The brackets are then firmly clamped to the table of the planer.

This arrangement insures equality in the dimensions of both cylinders and parallelism of the axes to the faces to be planed. While planing the steam-chest side and the exhaust flange, two tool heads are used together —one on the cross-rail and the other on the housing. After these two surfaces have been finished, the cylinders are turned 180 deg. and the pads are finished with the cross-rail head.

Cylinders are also machined on a milling machine and the corresponding fixture is shown in Fig. 2. The fixture which is adjustable, consists of two arbors for holding the cylinders. Each arbor can be turned 90 deg. and located by means of a locking pin. This arrangement allows the milling of surfaces on the sides of the cylinders without removing them from the fixture.

Both fixtures are in use in the Harrison, N. J., plant of the Worthington Pump and Machinery Corporation.

Plan Your Work Ahead

By C. J. Morrison

The editorials, "Just Suppose," are always of great interest to me as they have a way of bringing out points so that a lasting impression is made, and the remarks on page 76, Vol. 62, are particularly interesting as looms and automatic machine tools have more in common than one might suppose. Both may lose money for their owners or both may make money depending upon how they are handled. Both will certainly lose money when running upon a variety of products if handled in a haphazard manner.

Both looms and automatic machine tools are set up by specialists and run by operators who, in most cases cannot set them up or even make adjustments upon them, and unless the work is carefully planned the result will be numerous short runs, an unnecessary number of changes, more machines down at a time than the set-up men can handle, and the reverse of the condition with most of the machines running and nothing for the set-up men to do. These men are always high priced, but in order to keep the machines from being idle more of them than necessary are likely to be employed.

The remedy is to plan the work ahead as far as possible and where it consists in making a variety of standard parts to supply some assembly schedule to plan the work in cycles so as to keep the assembly properly supplied, and to give as long runs as possible without piling up too large a stock. These factors will have to be weighed in each case and a balance struck to suit the particular conditions. A sufficient quantity of some small inexpensive parts might be made at one

IDEAS FROM PRACTICAL MEN

time to last six months while in the case of some more expensive part the economical run, considering all the factors, might be only enough for two or three weeks.

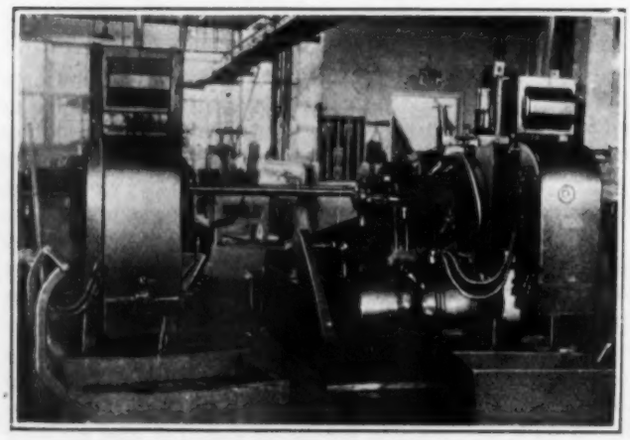
Probably a number of trial schedules will have to be made before a satisfactory one is achieved, but in any case the easiest way to make up the schedule is to take a large sheet of paper and lay it off with vertical lines to represent the hours of the day and days of the week and with horizontal lines to represent the machines. In some cases the paper will be so large that it will have to be fastened to the wall. One large shop runs the chart on rollers because the chart is laid out for a year at a time.

The process of making up the schedules is to assign trial batches of work to the machines and to mark off on the chart the hours and days required for each batch with a space between each for the amount of time required for a change-over. A chart of this kind has the great advantage that it presents to the mind through the eyes the time each machine will be running, the time it will be idle for set-ups and how many machines will be down at any time and makes it possible to plan the work for economical production. Such charts have changed losses to profits on both looms and automatic machine tools.

Tandem Centerless Grinders

BY CHESTER H. FRANKLIN

Here is a very clever "hook-up" for rough- and finish-grinding steel sleeves on two Cincinnati centerless grinding machines. Instead of having the machines fed by two operators, some bright individual in the plant of the Hoover Co., at North Canton, Ohio, thought



Tandem hook-up for centerless grinders

of the plan of hooking them up in tandem, as shown.

The machine at the right takes the roughing cut and the sleeves feed along the tube which connects the two machines and into the finishing machine without any attention. There is no fancy transferring or conveying device, the work coming out of the first machine just pushes the pieces ahead of it into the finishing grinder.

If, at any time, either machine should go out of commission for any reason, the other machine stays on the job and production goes on, though at a slower rate. It is a great time-saving proposition.

Fixtures Used to Grind the Web of a Driving Gear

BY WILLIAM DENTON

The helical bevel gear that is used as the main driving gear in the differential train of the Locomobile is located for grinding by means of the fixtures shown.

The first operation following the hardening is to grind the back of the web true with the face of the

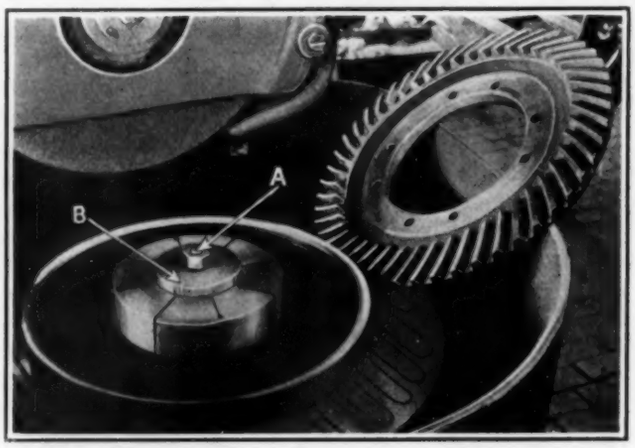


Fig. 1—Fixture to hold gears while grinding back of web

teeth, and the gear is located for this purpose by the fixture shown in Fig. 1 on the magnetic chuck of a Heald rotary grinding machine. A plug on the under surface of the fixture locates the latter concentrically with relation to the chuck.

The gear is laid, face down, upon the fixture with the beveled face of the gear resting upon the smooth rim. The split plug in the center of the fixture is then expanded to fill the hole in the gear by turning the small nut *A*, which draws the tapered bushing *B* into the center hole of the plug.

The magnetism of the chuck exerts some influence upon the gear but is not depended upon to hold it, since the magnetic currents are mostly absorbed by the fixture. The weight of the gear, together with the lightly

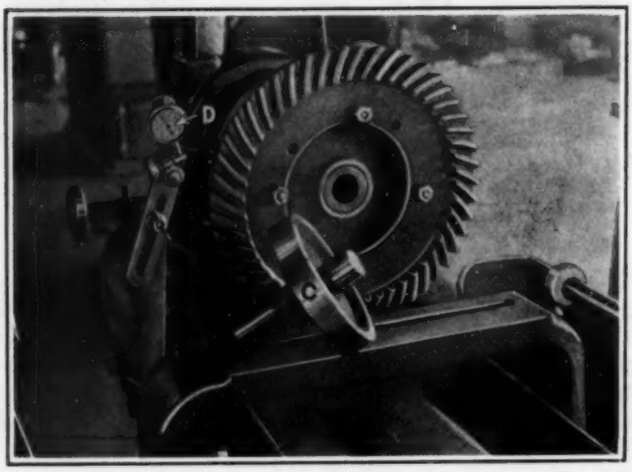


Fig. 2—Locating the gear to grind the center hole

IDEAS FROM PRACTICAL MEN

expanded plug in the center hole, provides sufficient resistance to drive the work against the drag of the grinding wheel.

In the second operation, shown by Fig. 2, the gear is bolted to a true faceplate by means of studs in the plate that pass through the bolt holes in the web of the gear. The shouldered plug *C*, the large diameter of which is slightly tapered, is set into the bushed center-hole of the machine spindle and holds the gear approximately true while the nuts are tightened.

These nuts are set up at first just tight enough to prevent the gear from slipping of its own weight. The plug is then taken out and the indicator *D*, mounted on an adjustable arm attached to the headstock of the machine, is brought to bear upon the periphery of the gear.

As the center hole of the gear is at this time slightly out of round from the hardening, the plug *C* cannot be expected to insure exact radial location, so the gear is trued radially by tapping it one way or another with a mallet as the indicator shows to be necessary. When finally trued, the units are tightened to hold the gear while grinding the hole.

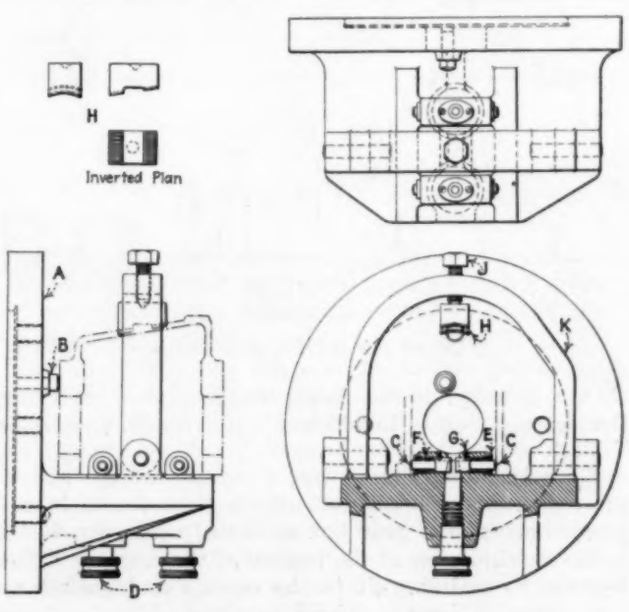
The face of the web is ground in a third operation, for which no fixtures are needed. The gear is laid face up on the surface of the magnetic chuck and centered approximately by pins in the face of the chuck that enter the bolt holes in the web of the gear. Exact radial location is not essential.

Boring Fixture for a Gear Box

BY S. A. WHITE
Rugby, England

The fixture shown in the illustration was designed for machining the bore of aluminum gear boxes, used on a light car.

The fixture comprises a body *A*, machined to suit the chuck flange of a turret lathe. The platform on the body carries the component, while the stop pin *B* gives the component its position lengthwise.



Fixture for boring a gear box

The location of the component crosswise is effected by the spring pins *C*, abutting the inner sides, and which can be adjusted by tapered screws *D*, so as to take up any variation in the casting. The end plugs *E* keep the springs *F* in place, while the setscrews *G* prevent the pins *C* from turning.

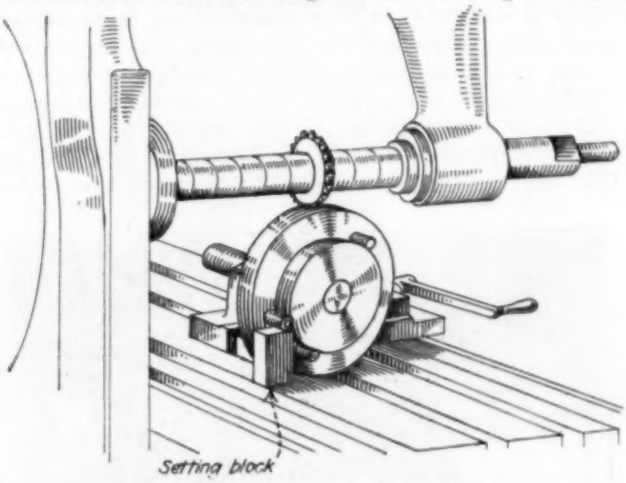
The component is clamped to the platform by the block *H*, operated by the screw *J* on the yoke *K*, which swings between lugs on the platform. The bottom face of the clamping block is of the same contour as the component at the particular position at which it bears, and is serrated to obtain a good grip.

Precise Indexing Without a Dividing Head

BY CHARLES KUGLER

Having occasion to cut three accurately but irregularly spaced notches in the periphery of a six-inch disk of cast iron, and having no dividing head available for the job, I proceed in the following manner:

After boring and rough-facing the disk on one side in the usual manner, a mandrel was forced into the hole and the work of turning and finish-facing was completed on centers. Instead of facing the opposite side of the disk flat, a step, or short shoulder was left at a diameter of four inches.



Spacing without a dividing head

Three toolmaker's buttons were now attached to this side of the disk, outside the diameter of the shoulder, in circumferential position to correspond with the desired notches and in radial position so that they would lie against the periphery of the shoulder. It was now an easy matter to calculate the chordal distances, based upon the radius of the 4-in. diameter shoulder, plus the radius of the buttons, and set the latter accurately by means of Johannson blocks and a vernier.

The mandrel was then laid on the bottom of the milling-machine vise with the disk projecting beyond the jaws. A ground block was placed on the table of the machine and the disk rotated until one of the buttons was in contact with it, when the vise was tightened to grip the mandrel. After cutting the first notch the disk

IDEAS FROM PRACTICAL MEN

was rotated to bring the other two buttons to bear, successively, against the same block and the respective notches were cut.

The set-up is indicated by the sketch, where it will be seen that the angular spacing of the notches will be as accurate as the setting of the buttons—which, by the use of the Swedish gages and a little trigonometry, may be very accurate indeed. The actual height of the steel setting block is of no moment so long as the top and bottom are parallel and the block is used in the same position for each notch.

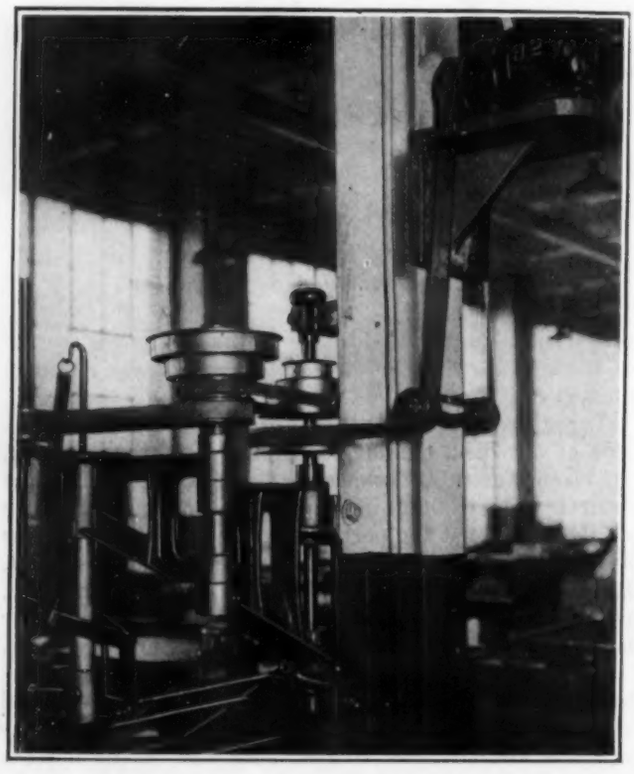
Getting a Motor Out of the Way

BY CHESTER H. FRANKLIN

The light assembly department of the Kelley Press division of the American Type Founders Co., at Elizabeth, N. J., uses several "elbow" radial-drilling machines for small work. These are very convenient as they can be easily swung to reach any point within their range.

One of the machines being mounted on a column of the building, it was not easy to locate the motor for driving the machine, without its being in the way. So the method shown was devised and, though it involves a quarter-turn belt which is not to be chosen when it can be avoided, the drive works out very nicely.

The motor is mounted on a substantial cast-iron bracket, bolted to the flanges of the column, and mounting for the idler pullers is also attached in the same way. The idlers are flanged pulleys and it will be noted that the bar that carries them is bent in the center.



How the motor was mounted

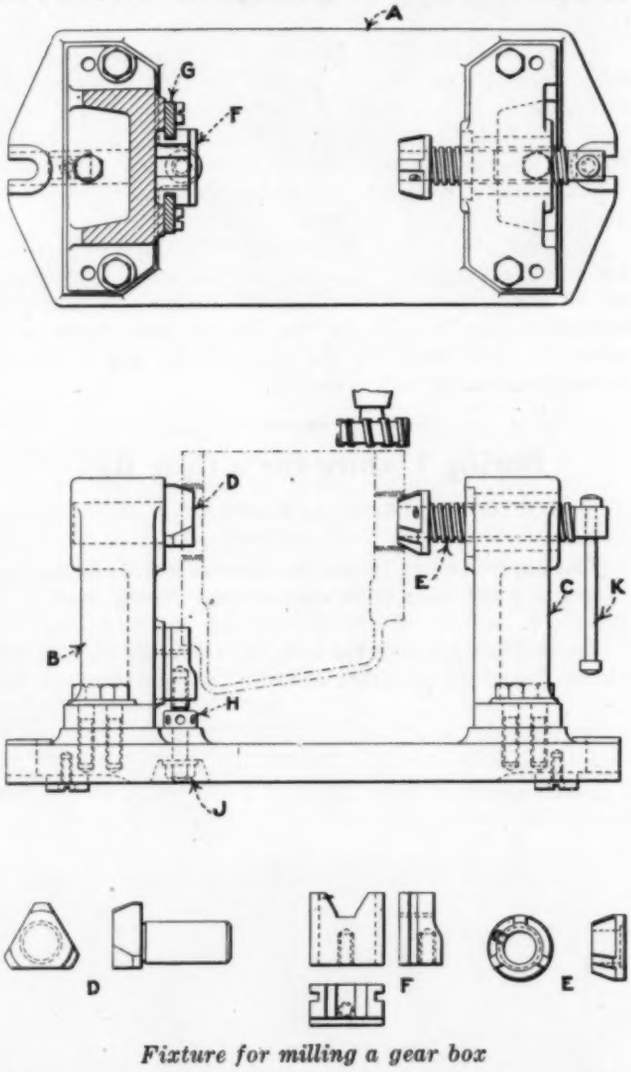
This brings the pulleys at the proper angle to guide the belt properly from the small pulley on the motor shaft to the larger pulley on the first shaft of the machine. This arrangement gets the motor and belt out of the way and has proved very satisfactory.

Milling Fixture for a Gear Box

BY S. A. WHITE
Rugby, England

The milling fixture illustrated in Fig. 1, was designed for machining the top face of aluminum gear boxes, used on light cars.

The base *A* is an iron casting, having tongues for fastening it to the machine table. Two brackets, *B* and



Fixture for milling a gear box

C, are attached to the base, the bracket *B* carrying the locating plug *D*, in which it is a drive fit, and also a V-block.

The adjustable plug *E* has a square thread, and is screwed into the bracket *C*. Both plugs locate in the rough bore of the gear box at three points, as shown in the detailed view at the bottom of the drawing. The V-block *F*, a sliding fit in the casting and guided by two strips *G*, locates a boss on the underside of the

IDEAS FROM PRACTICAL MEN

gear box. To allow for any variation in the casting, the V-block can be adjusted by the screw *H*, which is locked by the nut *J*. The tommy bar *K*, facilitates the turning of the plug *E*.

In operation, the gear box is located by the bore on the taper plugs *D* and *E* and by the boss in the V-block

The fixture is very simple to operate and the loading can be done very quickly.

Double-Acting Air Chuck for Ring Gears

BY A. J. QUINLAN
St. Catherines, Canada

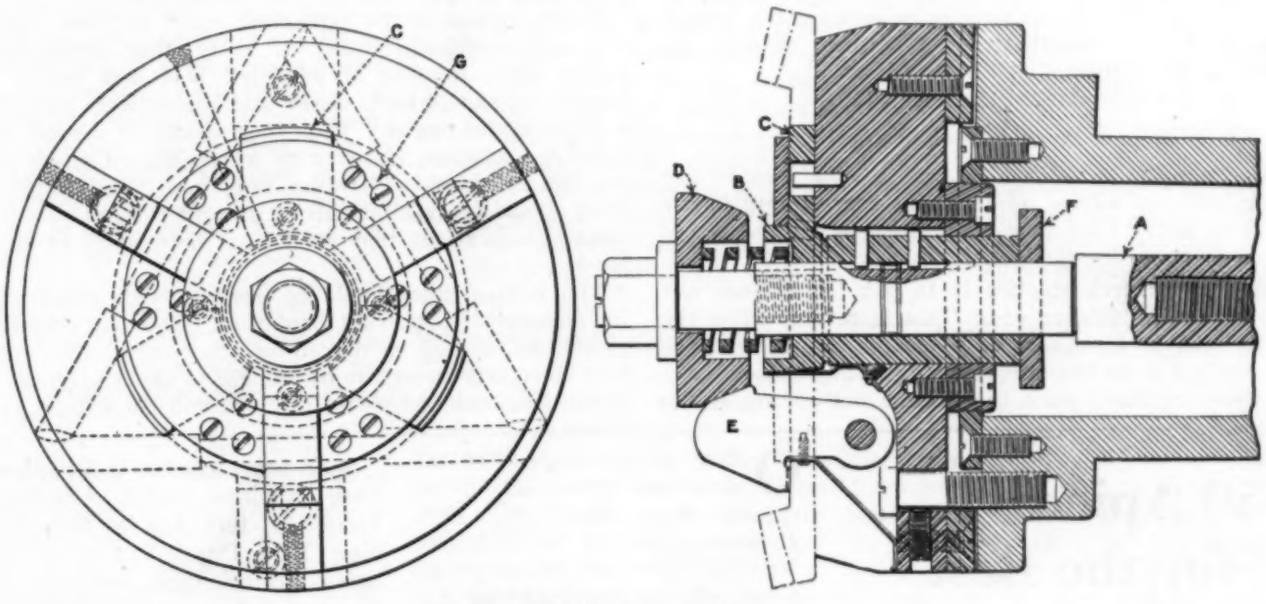
The illustration shows a chuck designed for performing the second operation on automobile ring gears, the bores of which have been machined and the backs faced on the first operation. This chuck is automatic, since the operator has only to put in the work, operate an air valve, and remove the piece when finished. Two machines are run by one operator.

Several chucks of this type have been made for use on Fay automatic lathes for different sizes of gears. All work very satisfactorily and require very little repairing. One has been working for two years. All parts including the body are packhardened, ground and nicely fitted, but present no difficulties in the making in an ordinary tool room.

The chuck has two independent sets of jaws, three in number, one for centering and the other for clamping and driving. Both sets are operated by a draw bar *A* pulled by an air cylinder on the back end of the machine spindle. The action is as follows: As the draw bar *A* moves inward, motion is imparted to the centering cone *B*, through the coil spring which is stiff enough not to collapse until the centering cone has expanded the three centering jaws *C* tightly against the bore of the gear. This completes the centering action. The draw bar continues its motion compressing the spring and causing the outer cone *D* to swing the clamping jaws *E* outwards until they pinch down hard on the finished web of the gear. On the return or opening stroke the clamping jaws *E* are swung back clear of the bore of the gear by flat springs, while the centering cone *B* is released by being forced back, when the shoulder on the draw bar *A* hits against the washer *F*.

The centering action is almost instantaneous, since it is only necessary for the centering jaws to collapse a few thousandths to allow the gear to come off. This small movement precludes any chip trouble. The centering jaws run in slots in the body of the chuck and are held in by retaining plates *G*.

The swinging or clamping jaws are also fitted into slots in the chuck body and take the torque or driving strain in addition to holding the work. The centering cone *B* is a snug sliding fit in the body of the chuck and a free fit over the draw bar. The outer cone *D* is a floating fit so that it takes a three-point bearing on the clamping jaws, thus distributing the pressure equally. With a 12-in. air cylinder carrying 80 lb. per sq.in. on the draw bar, no slippage takes place, though we use three stellite tools, carrying heavy cuts at high speed, on nickel-steel forged ring gears.



Air chuck with two sets of jaws

In order to have several of these chucks interchangeable from one machine to another, the machine spindles were fitted with hardened rings, ground in place on the machine, into which the pilot on the back of the chuck fits.

An essential point in the accuracy of the chuck, is that there be no eccentricity or "runout." For this reason the centering jaws are finish ground on the working diameter after the chuck is in place on the machine.

The centering cone is prevented from turning around to a new position by the pins shown.

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Figuring Gear Sizes

Q. Please send me a simple rule for figuring gears. What I want to know is this: If a man came into my shop and said, "Cut me a gear with 24 teeth, 1-in. bore and 2-in. wide," what should be the outside diameter, pitch diameter, depth of teeth, etc., and any other information you can give?

A. You could not calculate the tooth parts without having more information than is contained in the supposed order you have cited.

The pitch diameter of a gear is equal to the number of teeth divided by the pitch. The outside diameter is the number of the teeth, plus two, divided by the pitch. The depth of the teeth is equal to 2.157 divided by the pitch.

While we believe the above rules will enable you to make the calculations for such gears as you have to cut, we suggest that you read up on gears in the *American Machinists'* Handbook, or a textbook entirely devoted to the subject.

Use of Check Nuts

Q. To settle a debate by some of the men in our shop, will you advise which is the correct way to use a check nut. That is should the thin nut be placed above or below the thick one?

A. The general practice is to put the thinner nut on top of the thicker one. This is correct when the check nut is tightened only enough to prevent the thicker nut from becoming loose from any cause.

Some engineers place the thicker nut on top of the thinner one, the theory being that the upper nut is generally tightened as much as possible, pulling or stretching the bolt enough to take the strain from the under nut. In that case the outer nut becomes a clamping nut instead of a check nut.

In many cases both nuts of the same thickness are used, in which case there can be no question as to their relative positions.

Galvanizing Machined Work

Q. Can you tell us how to galvanize flanges that have been machined?

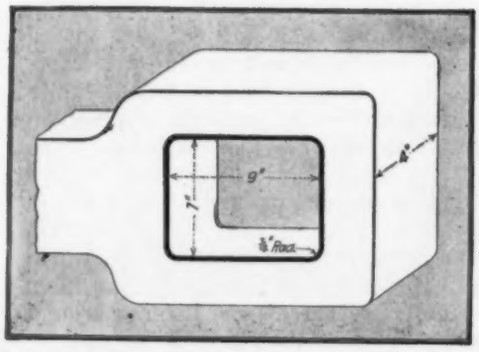
We have tried to galvanize such work, but have not been able to make the zinc stick to the iron, although in our opinion, all grease and oil had been removed.

A. Galvanizing is a process requiring considerable skill, which can be obtained only by experience.

Briefly, pieces to be galvanized must be free from rust and *chemically clean.* If rusty, they should be pickled in a solution of sulphuric acid and water—1 part acid and 10 parts water, and immediately washed in running hot water. Then they should be dipped in a hot lye solution, rinsed with water, dipped again in the lye, scrubbed with clean sand and rinsed again. They should be dried quickly to prevent rusting. In all cleaning operations they should not be touched by the hands.

The molten zinc should be covered with powdered sal ammoniac to prevent oxidation. The parts to be galvanized should be dipped in the molten zinc and held there long enough to be brought to the temperature of the zinc bath, otherwise the zinc will not adhere.

$50 Apiece for the Best Two Solutions



OPEN to all readers of the *American Machinist.* Final closing date—April 23, 1925. Judges—editors of the *American Machinist.* The two winning solutions will be published and discussion will be welcome. Other good solutions will be published and paid for at space rates, the names of the authors to be withheld if they so desire.

Send your solution to Practical Shop Problems Editor, *American Machinist,* 10th Ave. at 36th St., New York City. Put your full name, position and company on the answer in such a way that this information can be detached and a key number substituted.

Don't wait until the last minute to send in your solution.

Conditions of the Problem

To remove the metal bounded by heavy lines in the accompanying sketch in the most economical manner

MATERIAL: 0.50 carbon steel

DIMENSIONS: as per sketch

LIMITS: ± $\frac{1}{64}$ in. on all dimensions

QUANTITY: 100 per year in lots of one to four at a time

EQUIPMENT: Contestants may select the machine tools and other equipment they would like to use. Complete details of cutting tools must be given.

TIMES: Complete estimates of times of setting up machines and working time, floor to floor, as well as feeds and speeds are to be given.

NOTE—The job as specified must be completely finished so that no after operations are necessary.

Technical Abstracts

The Turret Lathe In the Railroad Shop

This article is well illustrated and deals with the economies that a turret lathe is capable of effecting, in fact, it is stated that it may ultimately become as indispensable in a well equipped railroad shop as it now is in the modern automobile shop.

Several machining tests were made on a 26-in. Libby high-powered turret lathe, the first being the machining of a locomotive crank pin from an old vanadium steel driving axle. Two of these were made from the one axle that weighed approximately 1,365 lb. and the time actually spent in handling and machining was 2 hours and 45 minutes. Both the axle and the crank pin are dimensioned in a drawing and there is a table showing the times for the respective operations. The second test involved the machining of a main crank pin from a new driving axle weighing 1,780 lb. The work was held in the chuck in such a way that it could be centered, rough-turned all over and cut off without changing its position. In this case the total handling and machining time, floor to floor, was 1 hour and 45 minutes.—*Machinery*, January, p. 346.

The Future of the Locomotive

An interesting editorial deals with the progress of invention and its rate along the years. Practically a century elapsed before any radical change was made in Watt's original design of engine in 1782 and it was not until 1884 that Parsons produced his turbine. Similarly in ships it was about one hundred years before the internal combustion engine appeared in the Diesel-engined ship Vulcanus of 1911.

In locomotive history practically one hundred years has gone by and only now are the beginnings of a new type visible. There is perhaps no more remarkable machine than the normal steam locomotive meeting a wider variety of conditions than any other engine and it does so by direct action. But as an offset to its marvellous adaptability it has a low thermal efficiency. This was not so important when coal could be had cheaply, but with the increase in the price of fuel it is important to economize on this, and considerable research has been done to find out whether other types will efficiently displace the steam locomotive.

There are two main lines that are being followed, one in the direction of the steam turbine locomotive that has been worked out successfully in the Ljungstrom design, and the other is in the direction of the internal combustion engine that would be connected direct to the wheels or perhaps through internal gears.

This solution of the problem has been taken up by the German State Railways in the "Lomonossoff" engine. This is an oil engine locomotive with compressed air transmission. High-speed Diesel engines will compress air into a receiver from which it will be delivered after reheating at a pressure of 100 lb. per sq.in. to the cylinders.—*The Engineer* (England) Nov. 14 p. 557.

Grinding Adams Axle Parts

Four grinding operations are performed in finishing rear drive axles. The taper is finished in three operations, while another operation takes care of the straight part at the gear end. The finished surface is 5¼ in. long, 1.350 in. cut the large end, and 0.916 in. cut the small end. The axle end is swedged to form the taper so that no other machining operation on this surface is necessary before grinding. The first operation on this surface is performed on a plain grinding machine, capable of accommodating work 10 in. in diameter and 36 in. long, fitted with a manufactured corundum wheel, 14 in. in diameter, with a 4-in. face, 246 grit, M grade vitrified bond. This wheel is operated at a peripheral travel of approximately 6,000 ft. per min., while the work speed is about 20 ft. per min.

The second operation is performed on a plain grinding machine, capable of accommodating work 10 in. in diameter and 36 in. long, fitted with a manufactured corundum wheel, 18 in. in diameter, with a 6-in. face, 366 grit, K. grade vitrified bond. This wheel is operated at a surface speed of approximately 6,000 ft. per min., while the work speed is about 20 ft. per min.

The third or finishing operation is performed on a plain grinding machine fitted with a manufactured corundum wheel, 18 in. in diameter, with a 2-in. face, 366 grit, K grade, vitrified bond. This wheel is operated at a surface speed of 6,000 ft. per in., while the work speed is 30 ft. per min.

There are four illustrations showing the processes.—*Abrasive Industries*, January, p. 9.

Saving In Material Handling

The question of improving handling methods in the individual plant, whatever its nature and its product, is one that is well worth any time and trouble spent in its solution. It is a rare case which, after investigation, shows no possibility of further savings, says George E. Hagemann.

He instances the foundry of the Commonwealth Steel Co. where a first installation was made for the purpose of conveying core sand to the coremakers' bench. This unit is approximately 350 ft. long. In 1918 another unit approximately 550 ft. long was installed for facing sand, and recently a third conveyor 350 ft. long for core sand has been installed and a fourth is contemplated.

The return line of a conveyor system for molding sand picks up the sand dumped through gratings when the flasks are shaken out. This sand is carried by the conveyor and dumped upon an inclined belt conveyor feeding a crusher. From here it passes to a screen, over a belt conveyor, and into the sand mills.

Other examples are given and there is a table showing the economic value of different types.—*Management and Administration*, January, p. 51.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Don't Fall for the Competitive Trial Bait

WHILE we may agree that "competition is the life of trade"—in principle—there are reservations that machine builders will do well to remember. It may sound fair and open to invite each of the builders of a competing machine to each install one for trial, the best machine to get the order—but there is another side to the story.

Every reputable builder of a machine is perfectly willing to guarantee its performance, either as to production or accuracy, or both. But he should not be asked to install a machine in a customer's plant, provide an operator, and turn a new machine into a second-hand one for the education of the customer.

Competitive tests are not new—machine builders have been the victims at various times in the past. But there are reports of an attempted renewal of the practice by some of the large buyers of machinery. The maker is given the opportunity(?) to set up a machine for competitive trial, the winner to get an order, the losers to remove their machines at their own expense. Some of these trials have run several months, during which time the customer gets his parts made for nothing and the losers get nothing but bills for freight, cartage and wages and a second-hand machine. Even the winner may have far more expense than profit.

The hope, of course, is for large orders in the future if not immediately. But what machine building concern is justified in gambling to this extent, for trials of this kind run into big money. Do not forget that any concern large enough to tempt a machine builder into any such competition can well afford to buy one of each machine in question and determine for itself which is best for the work in hand.

Another Investigation

IN DIRECTING the Federal Trade Commission to investigate the General Electric Co. and its control of public utility companies the expiring Senate is running true to form. The people, with whom the Federal Trade Commission is none too popular, will heave a sign and murmur "Another investigation."

No one questions the sincerity of Senator Norris, the author of the resolution. He is frankly committed to government ownership of public utilities and he is willing to fight for what he believes to be right. But his effort to investigate the financial affairs of the General Electric Co. and its many thousands of stockholders looks like a very large order. In fact, doubts have been expressed by some people as to the constitutionality of investigating stockholders.

So far as the company itself is concerned it has been so thoroughly investigated that one more or less makes little difference. In each case, so far as we know, where irregularities have come to light they have promptly been rectified. There is little doubt that the intentions of the men who direct its activities are to follow the letter of the law, and still less that the present investigation will bring to light anything very reprehensible.

All-Round Machinists Are Still Needed

JUST as we get comfortably settled in the notion that the all-round machinist is as dead as the dodo and ready for a monument of the King Tut order, we run into a shop where the cry is for just that kind of men.

The last instance was in the Pittsburgh district, and it is by no means uncommon in that section. There are huge manufacturing plants in that district, it is true, where jig, fixture and operation sheet, plus a careful foreman with an eagle eye, are the main requirements. But there are shops, and large ones too, where jigs and fixtures are conspicuous by their absence, and where repetition work is almost unknown.

There are also shops, here and elsewhere, that are in the throes of the growing pains due to changing from one class to the other. During this transition process the old timer is playing his part. And in many cases he will pass out along with the necessity for his type.

But whenever we get the idea that the large manufacturing plant with its specialist operators is the only one to consider, it is a good thing to visit plans building heavy, special machinery and realize that there is still a place for the man who can handle all classes of work.

Just Suppose

JUST suppose that every machinery builder had the business sense, the backbone, the common honesty, and the freedom from economic pressure to keep away from price-cutting in any of its various forms. What a help it would be to the machinery business and how much pleasanter the relations with customers would be. Nobody would suspect that somebody else was getting a better price.

We'll admit that progress is being made in acquiring the first three of our four factors and that we don't quite see how to get around the other one. But wouldn't it be a fine thing to lick all four of those problems?

Just suppose.

Shop Equipment News

Brown & Sharpe Toolmakers' Buttons

The set of four toolmakers' buttons, illustrated in Fig. 1, is being made by the Brown & Sharpe Manufacturing Co., Providence, R. I., in three sizes that measure respectively 0.3, 0.4 and 0.5 in. in diameter. The

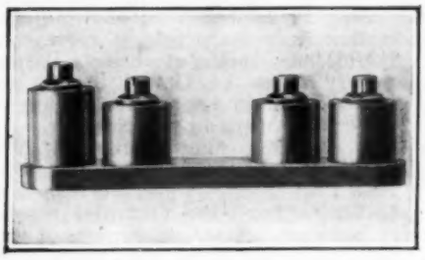


Fig. 1—Brown & Sharpe Toolmakers' Buttons

set is mounted on a protecting steel base.

Three of the buttons are $\frac{1}{2}$-in. high while the fourth measures $\frac{3}{8}$-in. This difference makes it possible to locate two holes as illustrated in Fig. 2, which may be set so close together that the indicator point will not pass between the buttons. To locate a hole for boring, the center is first laid out and tapped for the $\frac{1}{8}$-in.-40 button holding screw. The button, which is bored large enough to allow side motion with this screw, is then set accurately in place by measurement and secured by the screw. The work is finally clamped in a face plate and centered for boring with the use of an indicator on the button. The button is then removed and the hole is ready to be bored.

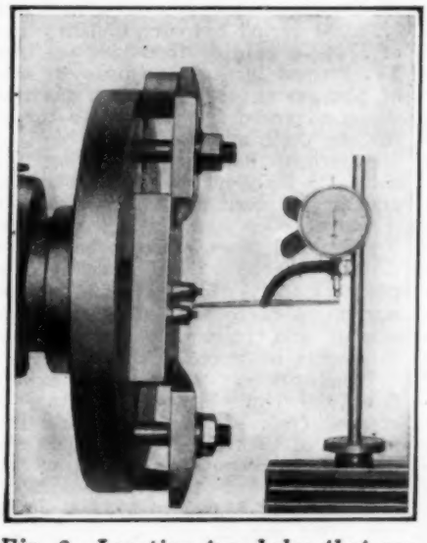
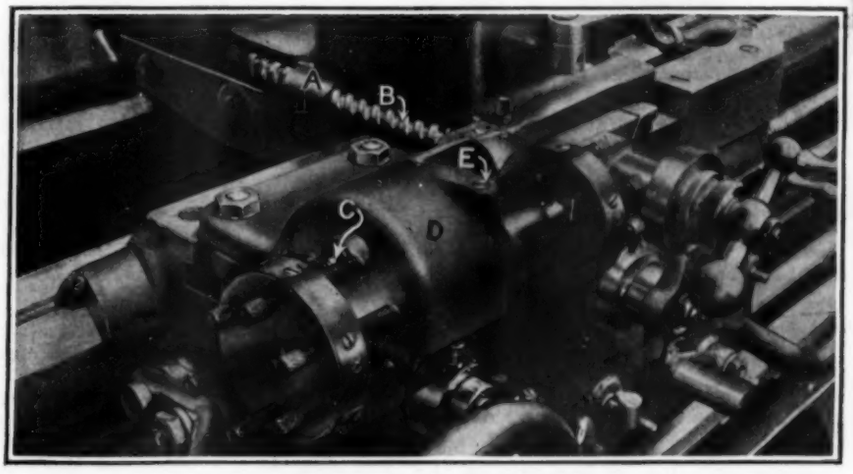


Fig. 2—Locating two holes that are close together

Schellenbach Multiple Diameter Stop

An attachment designed for use on the carriage of a lathe, to set the tool for a number of diameters, for duplication of production work, has been designed for the market by W. L. Schellenbach, Consulting Engineer, Rawson Bldg., Cincinnati, Ohio. The illustration shows it in position with the guards that protect it from chips removed.



Schellenbach Multiple Diameter Stop

A nut *A* is doweled and bolted to the side of the carriage cross-slide.

The longitudinal motion of this nut with the slide, in either direction, imparts rotation to the coarse pitch screw *B*. This screw bears in the housing of the attachment *D*, is restrained as to end play by thrust washers and terminates in a miter pinion. This pinion meshes with a miter gear driving a shaft inside the housing that imparts motion to a spur gear in the main body of the housing. The spur gear drives a pinion that is free to rotate, but that is constrained from any end motion. The shaft or shuttle which it drives, however, through a feather key, is threaded its entire length and rotates in corresponding threads in the housing through which it protrudes on both ends. Point *C* in the illustration shows one end of the shuttle thus screwed out against one of the diameter limiting set screws.

Another shaft fitted through the housing carries two circular heads, in each of which there are six knurled set screws that act as limit stops. The spring plunger under the screw *E* will keep any pair of these screws opposite the ends of the shuttle. In each end of the shuttle there is a set screw which can be adjusted on fine threads to compensate for change in tool position without disturbing the setting of the limit screws. Carriage motion inward is limited by the right-hand set of screws and outward by the left-hand set. The housing itself is secured to the wing of the carriage by means of bolts in the carriage T-slot.

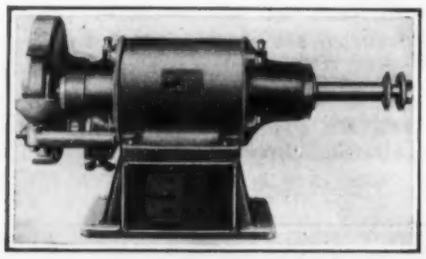
Since any looseness must be taken up in the carriage cross-feed screw, before the carriage will move in either direction, and since the action of the diameter stop is dependent on and opposed to the carriage motion in either direction, the accuracy of the tool setting will be independent of any looseness in the feed screw or stop mechanism.

SHOP EQUIPMENT NEWS

The unit can be taken from service without removing it from the carriage by screwing out a set screw which protrudes from the left end of the housing and holds against the end of the miter driven shaft to keep the miters in mesh.

Hisey Combination Grinder and Buffer

The Hisey-Wolf Machine Co., Colerain Ave. and Marshall St., Cincinnati, Ohio, has added to its products a line of combination grinders and buffers which can be adapted to



Hisey Combination Grinder and Buffer

either floor or bench mounting. There are two sizes driven respectively by ½- and 1 hp. motors.

The machine illustrated is of the bench type by virtue of the base design. In addition to the higher base, the end frame on the right-hand side, for floor mounting, is designed to carry an extension sleeve to inclose the projecting spindle.

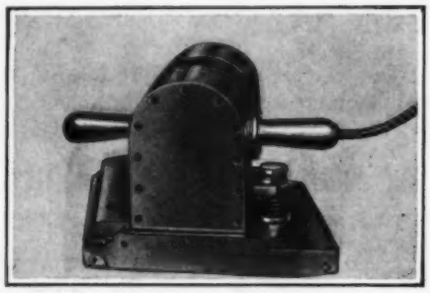
The machines are equipped with ball bearings, two for the open spindle and four in the case of the inclosed spindle. A starter switch is designed to give protection against overload when starting and while running. Flange washers are finished all over and the inner ones, while keyed to the spindle, can be removed by hand. Approved adjustable guards surround the 8-in. diameter grinding wheels.

Barker Model E Portable Sander

R. L. Barker & Co., 642 West Washington Blvd., Chicago, Ill., have developed the sander illustrated.

A ½-hp. universal motor, protected against dust, furnishes power through gears to the sander drum which rotates at 4,000 r.p.m. One side of the aluminum housing containing the drum and motor is hinged to the base frame, which is of the same material, and the other is held by means of a screw and spring.

Pressure on the handle above this spring brings the drum down to contact with the surface to be sanded. Relieving this pressure will allow the



Barker Portable Sander

spring to return the drum to clear the work, so that upon stopping or coming to the end of a cut there will be no mark left.

The frame is mounted on rollers at either end. The abrasive, 6 in. wide, is held on the 4-in. diameter drum with a special eccentric clamp that permits quick change. The machine measures 9 in. by 10 in. by 15 in. and weighs 23 pounds.

The Italian Market for American Machine Tools

The growing popularity of American machinery in Italy should encourage the American machinery exporter to renewed efforts in foreign markets, according to the Industrial Machinery Division of the Department of Commerce.

American exports of industrial machinery to Italy, as indicated by United States customs returns, have increased approximately 81 per cent in the first nine months of 1924 in comparison with the corresponding period of 1923 when comparative figures of $1,070,887 and $591,397 were reported. According to figures given in Italian import statistics, sales of American machinery in that country have practically quadrupled in the last two years. Conclusions reached from a study of both sources of trade information above indicated a decided advance in sales of American industrial machinery of virtually all types in Italy and show further the lessening ability of low-exchange European countries to compete successfully in the Italian machinery market. The leading factors in this gain are increased purchases of mining, oil-well, and pumping machinery—especially mining machinery—and a gain of nearly 200 per cent in purchases of metal-working machinery. Of the latter, orders for various types of sharpening and grinding machines showed the greatest advance.

Italy advanced from 29th in importance among world markets for American industrial machinery in 1921, to 24th in 1922, and 22nd in 1923, outranking such markets as the Dominican Republic, Dutch East Indies, Germany, and Sweden, as a purchaser of this equipment and it is expected that, when returns for the whole of the year 1924 are available, Italy's position will be further advanced in comparison with other machinery markets. The potentialities of the Italian market are indicated by 1919 figures, showing that in that year Italy bought more than $12,000,000 worth of industrial machinery from the United States, and ranked sixth in importance as a purchaser of American machinery.

In the first nine months of 1923, Italy purchased mining machinery valued at $5,233 which increased to $115,609 during the first nine months of last year. American exports of rock drills increased from practically nothing in the first nine months of 1923 to over $17,000 during the corresponding period in 1924. Exports of steam pumps showed a slight increase during the latter period, while sales of American miscellaneous pumping machinery gained from $11,799 to $25,070. Considering American exports of mining, oil well, and pumping machinery as a whole, an increase of nearly sevenfold was experienced during the first nine months of 1924.

Metal-Working Machinery

Italy ranked 15th as a market for American metal working machinery in the years 1922 and 1923. In the latter year Italy absorbed $142,263 worth of this equipment, or about twice that purchased by such Latin American countries as Peru, Colombia and Venezuela. Italy's purchases of machine tools in the first nine months of 1923 amounted to $78,689, which increased to nearly $230,000 during the corresponding part of 1924—a gain of about 200 per cent. The largest increase occurred in sales of sharpening and grinding machines which advanced from $7,470 to $59,180 for the periods mentioned.

American exports of milling machines to Italy increased 100 per cent, and larger increases occurred in shipments of such items as gear cutters, bending and power presses, boring and drilling machines and machine tool parts. Exports of foundry and molding equipment decreased during the latter period, and pneumatic portable tool shipments advanced.

Woodworking machinery exports from the United States to Italy increased from $1,264 for the first nine months of 1923 to nearly $28,000 during the corresponding period of last year. Sales of air compressors increased from $5,000 to $10,000 during the latter period.

Exports of textile machinery to Italy increased by over $100,000 during the first nine months of last year.

News of the Week

Class I Railroad Reports Show Earnings Last Year Less Than in 1923

Slight decrease in revenues and in operating expenditures

Class I railroads representing a total mileage of 236,190 miles had a net operating income in 1924 of $987,133,650, or a return of 4.35 per cent on their property investment, according to reports filed by the carriers with the Interstate Commerce Commission and tabulated by the Bureau of Railway Economics. In 1923 their rate of return was 4.49 per cent.

Although the railroads were operated in 1924 with the greatest efficiency in their history, they failed to earn a return of 5.75 per cent, which has been set up by statute as a fair return for them.

Gross operating revenues of the Class I carriers in 1924 amounted to $5,986,492,100, a decrease of $373,931,100 or 5.9 per cent compared with the preceding year. Operating expenses amounted to $4,558,307,800, a decrease of $386,827,600 or 7.8 per cent.

The freight revenue for the year 1924 amounted to $4,347,916,000 compared with $4,625,786,000 in 1923. This was a reduction of six per cent.

The passenger revenue amounted to $1,076,615,000 compared with $1,147,578,000 for 1923, a reduction also of six per cent. These totals include the amounts received by the railways in the form of a surcharge on sleeping and parlor car tickets which aggregated $37,489,000 in 1923 and approximately the same amount in 1924.

Revenues received for the carriage of mail increased about five per cent; express revenue showed a smaller relative decline than freight or passenger revenue; "all other" revenue declined about six per cent.

Maintenance Expenditures

Maintenance expenditures during the year amounted to $2,072,442,480, a reduction of $223,035,260 or nearly ten per cent under 1923. Maintenance of way expenses in 1924 showed a reduction of $19,590,091 or 2.4 per cent while expenditures for maintenance of equipment were reduced $203,445,171 or 13.8 per cent.

The fact that their net operating income was greater in 1924 than the previous year while the rate of return was less, resulted from additional expenditures for improvements and betterments to enable the railways to continue to handle successfully the enormous traffic offered them by the shippers.

For the month of December alone the net operating income of the Class I roads amounted to $86,988,470 compared with $70,030,890 in December, 1923. Gross operating revenues for the month totaled $505,522,950 an increase of $10,864,705 or 2.2 per cent over December last year. Operating expenses for December amounted to $381,415,250, a decrease of $6,758,560 or 1.7 per cent.

Ten Million Dollar B.-M.T. Expenditure

Plans for the construction of extensive repair shops and yards for the B.-M. T. to cost about $10,000,000, were announced recently by the Board of Transportation, New York City. In making the announcement, the board said the plans had been pushed to completion despite "the insistence of the B.-M. T. management that more time was required for study of the facilities that the city was to provide."

"The plans call for the most complete repair shops and yards ever devised for passenger train service," the announcement states. "The main repair shops building will be sufficient in capacity and equipment to maintain in service and in a state of repair 3,000 steel cars of the type now in use on the B.-M. T. system. The main building will contain machine shops, service shops, track assembly, motor and truck shops, foundry and blacksmith shops, wheel and axle shops, carpenter shops, lumber storage, paint shops, cotton waste and oil storage and car washing stands. The electrical repair shop soon to be inclosed will be for all motors and motor parts and for every electrical phase of motor and trailer car used in the rapid transit service."

Information may be obtained from the Board of Transportation, New York City.

More Buses in Use Survey Shows

Twelve thousand five hundred buses and vehicles for bus use were built and placed in service during 1924, states Edward F. Loomis, secretary of the National Motor Truck Committee, National Automobile Chamber of Commerce, in *Bus Transportation* for February. This fact, together with the estimate of 2,500,000,000 passengers carried in old and new buses in 1924, indicates, the writer points out, that the bus is fast assuming a major position in our transportation system.

When added to buses in operation prior to 1924, these new vehicles bring the total number of buses in service in the United States and Canada on Jan. 1, 1925, to 53,000. The gain during 1924, therefore, represents approximately 25 per cent of the total now in use. Other figures obtained from bus operators by *Bus Transportation* forecast a corresponding growth during the present year.

The figures and estimates in the article, which is based on a survey to which *Bus Transportation*, the American Electric Railway Association, *Electric Railway Journal*, and the National Automobile Chamber of Commerce contributed, show the present distribution:

Common carrier independents	31,100
Electric railways	3,000
Hotels	1,000
Schools	15,000
Sightseeing, tourist and contract	1,500
Industrial use, including real estate, department store, apartment house, garage and factory service	1,075
Railroad terminal companies	250
Total	52,925

That electric railways realize the possibilities of the bus as a transportation medium is attested by the fact that while only 1,200 buses were used in this field on Jan. 1, 1924, no less than 3,000 were used on Jan. 1, 1925, representing an increase of 150 per cent. Three steam railroads are also operating buses in common carrier service through subsidiaries.

Gisholt "Old Timers" at Banquet

The Gisholt Machine Co., Madison, Wis., recently gave a banquet for the fifty-four men who have been in the employ of the company for more than twenty years. There were present eight men who had been with the company from thirty to thirty-three years, nineteen with from twenty-five to twenty-nine years of service, and twenty-seven who had served from twenty to twenty-four years. The total service to the company amounted to 1,319 years.

Recognition in the form of service pins was also made to men who had been with the company for more than five years.

Italian Citröen Company Is Formed

An Italian corporation called Societa Annonima Italiana Automobili Citröen for the manufacture of Citröen (French) cars has been formed and will have its legal headquarters at Piazza Cavour 5, Milan.

Notes of Washington Activities

By Paul Wooton

A significant phase of the air service problem is that the views of those who have been directing the various branches of that work diverge very widely. Expression of these views generally is accompanied by no small amount of emotion. This leads some to the conclusion that some cooling down should precede any conclusions.

There is a reason why the United States does not have to keep pace with Great Britain, France and Germany in this branch of military preparedness, it is pointed out. The proximity of those countries form a different situation. For 2,000 years the channel was the first line of British defense. Less reliance can be placed on it now, but the Atlantic still remains an effective first line of defense for this country, it is pointed out, even against airplanes.

The probabilities are thought to indicate that we will have no major war for twenty years. The world has no stomach for war and moreover does not have the financial structure to support a war. Under such circumstances some would cut military and naval expenses below their present totals and use that money for government efforts that pay big dividends to the public and make available new wealth to share in bearing the tax burden.

While there is some insistance in Congress for tariff revision, there is a feeling in other quarters that the next session of Congress, that precedes the congressional elections, hardly is the time to undertake such a work.

This conclusion is based on the assumption that the present tariff has worked out fairly well. No protests from the public are in evidence.

Japanese Trade

American immigration policies apparently have had little effect on our trade with Japan. There has been some falling off in the volume of business, it is true, but analysis shows this to be due largely to the disturbances in China. An effort has been made in certain quarters to interpret the recent Japanese tariff increases on the so-called non-essentials as being a retalatory move. There is nothing to substantiate such a view, it is declared.

Oratorical outbursts on foreign debts have brought neither money nor goodwill. The administration, it will be noted, has not contributed to the debate, although it is apparent that it has been necessary to resist the temptation to do so.

Much emphasis is being placed on statements that payments to the United States must be made in goods. This is regarded as an unsound contention, as American tourists spend enough in France to make a respectable annual payment. These payments do not have to be made in goods or gold. It can be carried on the back of the entertainment service furnished the American tourist.

The British by their policy are making us out as the Shylock of the situation and they are requiring only such blood as is necessary to pass on to us. There has been no suggestion, for instance, to tender on the settlement certain British holdings in Africa which might prove attractive to the United States. One of these areas has large possibilities as a diamond producer that might prove attractive to the nation that happens to be the largest purchaser of that gem.

Plan Student Branch of S. A. E.

Students of engineering courses at universities and colleges will be eligible to membership in a students' branch of the Society of Automotive Engineers if present plans to instal such branches are carried out by the society.

There has been an insistent demand by a number of engineering educational institutions that the work of the society be extended to include student activities, and work now in progress by the council of the society is expected to result soon in the announcement of definite plans for the extension of its services to college students.

Report on Exports of Hardware

The United States increased the value of its foreign sales of hardware, hollow ware, stoves, tools, lamps, abrasives, and similar products in 1924 as compared with the declared value of the exports of these commodities during the preceding year, according to the Iron and Steel Division of the Department of Commerce. An advance of approximately 5 per cent is noted. Cutlery, needles, builders' hardware of brass and bronze, tin and galvanized hollow ware, and lamps and illuminating devices, except electric, are the specific lines which show increases. The weight of abrasive exports was less than in 1923, but the value thereof was higher. The value of the trade in certain hardware products, ball and roller bearings, chains (other than sprocket and power transmission chains), certain types of stoves and furnaces, enamelled hollow ware, aluminum utensils, and certain lines of tools, declined.

The number of scissors and shears exported was less than half the sales for the year 1923, although the value did not drop quite one-third. Table and kitchen cutlery exports declined considerably.

Foreign consignments of wheels of emery or corundum and grindstones weighed less in 1924 than in 1923, but the exportation of other natural abrasives, hones, and whetstones, etc. was considerably heavier, although it was evaluated at a much lower figure. Activity slackened in artificial abrasives crude or in grains, but the sales of wheels of artificial abrasives and of other artificial abrasives, including steel wool, abrasive paper, etc., advanced.

The loss in the weight of the exports of ball and roller bearings and parts thereof was heavy. Although the trade in sprocket and other power transmission chains was accelerated, foreign sales of other chains fell away from the 1923 transactions.

Increased activity was experienced in transactions for axes, saws, and miscellaneous mechanics' tools. Exports of files and rasps, although outnumbering those of the preceding year, fell short of the 1923 value. A heavy loss was sustained by foreign consignments of woodworking augers and bits. Exports of hammers and hatchets and shovels and spades also slowed up somewhat.

Marshall & Huschart Will Hold Exhibit

During the week of March 2 an exhibition of machine tools will be given at the show rooms of the Marshall & Huschart Machinery Co., 17 S. Jefferson St., Chicago. It is announced that approximately thirty machine tools will be demonstrated under power doing the class of work each is best suited for and that no "stunt" jobs will be undertaken, but that the exhibition and demonstrations will be kept to practical problems.

So that all those who are interested in the exhibit may have an opportunity of attending, the show room will be open evenings during the week with the exception of Monday evening. Besides the usual sales force of the Marshall & Huschart company, manufacturers' representatives and demonstrators will be present.

The following machinery and machine tool companies have signified their intention of being represented:

Abrasive Machine Tool Co., East Providence, R. I.
Acme Machine Tool Co., Cincinnati.
Baker Brothers, Toledo.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Bullard Machine Tool Co., Bridgeport, Conn.
Cincinnati Bickford Tool Co., Oakley, Cincinnati.
Cincinnati Milling Machine Co., Cincinnati.
Cincinnati Planer Co., Cincinnati.
Cochrane-Bly Co., Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gould & Eberhardt, Newark, N. J.
Keller Mechanical Engineering Corporation, 76 Washington St., Brooklyn.
Landis Machine Co., Waynesboro, Pa.
Lodge & Shipley Machine Tool Co., Moline, Ill.
National Automatic Tool Co., Richmond, Ind.
Oilgear Co., 655 Park St., Milwaukee.
Oliver Instrument Co., Adrian, Mich.
Sebastian Lathe Co., Covington, Ky.
Sipp Machine Co., Paterson, N. J.
V & O Press Co., Hudson, N. Y.

Will Buy Equipment

The St. Louis Southwestern Railroad Co. has applied to the Interstate Commerce Commission for authority to assume obligation for $1,530,000 equipment trust certificates for the purchase of 1,000 forty-ton steel under-frame box cars.

Personals

PERCY M. BROTHERHOOD has resigned from Manning, Maxwell & Moore, Inc., New York City. Mr. Brotherhood is not yet ready to announce his plans for the future.

P. C. GUNION, advertising manager of the Hyatt Roller Bearing Co., Harrison, N. J., has been made a member of the sales board of the company. He will also head the market research activities in addition to his advertising work.

BURTON G. TREMAINE, Cleveland, was elected to the directorate of the Miller Co., Meriden, Conn. Mr. Tremaine is connected with the General Electric Co. CHARLES O'CONNELL, auditor of the Miller Co., was elected assistant treasurer.

JOHN P. MORIARITY, for the past ten years superintendent of the rolling mill department of the Timken Roller Bearing Co., has resigned and will become identified with the United Alloy Steel Corporation.

I. J. REUTER, general manager of the Remy electric division of the General Motors Corporation, has been appointed general manager of the Olds Motor division.

J. W. HILDEBRAND, formerly connected with the Jones Foundry & Equipment Co., Chicago, has recently joined the sales force of Foote Bros. Gear & Machine Co., Chicago, as sales engineer.

DEAN WELCH of Nutley, N. J., was elected a director of the Bristol Brass Co., Bristol, Conn., at the annual meeting, filling the vacancy caused by the retirement of his father, PIERCE N. WELCH of New Haven.

G. H. FELTES, one of the organizers of the United States Electrical Tool Co., Cincinnati, Ohio, which company he helped organize in 1905, has sold his interest in the above company. He was secretary and treasurer until 1920, at which time he was appointed treasurer and sales manager until February, 1925. J. A. SMITH, who went into business with Mr. Feltes, purchased his stock.

HARRY E. PENNY and J. G. PRICE have purchased from L. H. THALMAN the machinery and equipment of the Thalman Welding Co. at State and Market Sts., San Diego, Calif.

C. L. GOODRICH has recently returned to the Pratt & Whitney Co., Hartford, Conn., where he will occupy the position of assistant to the general manager Mr. Goodrich was formerly connected with the Pratt & Whitney company during which time he was associated with the company's gage business. He left the Pratt & Whitney company to be acting general manager of the Bement Works in Philadelphia. He has been recalled to resume his work on gages, and also to take charge of special work.

J. P. BROPHY has retired as vice-president and general manager of the Cleveland Automatic Machine Co., Cleveland, Ohio. He had been with the company for about 30 years.

BRUNO C. LECHLER has acquired an interest in the Eureka Tool & Machine Co., Newark, N. J.

WILLIAM M. STOCKER, formerly with the F. X. Hopper Co., Inc., Glenarm, Md., has accepted a position with the Cameron Machine Co., Brooklyn.

OTTO WARTENWEILER, consulting engineer, has joined the organization of the Smith-Emery Co., Los Angeles, Calif., and will have charge of the physical testing and mechanical engineering.

A. C. COOK was promoted from the position of general sales manager of the Warner & Swasey Co., Cleveland, to vice-president, at the annual meeting of the company. Mr. Cook also becomes a member of the Board of Directors. He entered the employ of the company twenty-four years ago, has served as district manager of the New York territory and has represented this company abroad on three extended trips in Europe. The last ten years he has been general sales manager. At the same meeting the Warner & Swasey Co. presented E. P. Burrell, director of engineering, and William J. Burger, works manager, with gold watches. This is in accordance with a custom established some years ago in recognition of twenty-five years of continuous service with the company.

A. C. Cook

CHARLES B. CHANCELLER has joined the Union Furnace Manufacturing Co., Altoona, Pa., as vice-president and sales manager. He was formerly with the Baldwin Tool Works, Parkersburg, W. Va.

CHARLES F. BRANDT has resigned as vice-president and general manager of the Racine Manufacturing Co., Racine, Wis.

PERRY W. RICE, for many years connected with the Chicago sales staff of the Pratt & Whitney Co., Hartford, Conn., is now with the Chicago office of the Hendey Machine Co., Torrington, Conn. His headquarters are at 565 W. Washington Boulevard.

D. A. BURKE has resigned as president, general manager and director of the Peerless Motor Car Co. effective Feb. 16. He will be succeeded by EDWARD VER LINDEN, formerly president and general manager of Olds Motor Car Co.

WALTER R. GUILD, Belmont, Mass., and IRVING S. DECKER, Cambridge, Mass., have acquired the plant of the International Abrasive Co., Waltham, Mass.

HENRY HARRIS, comptroller with the Locomobile Co., Bridgeport, Conn., has resigned to accept a position with the Willys-Knight Co., Philadelphia. Mr. Harris will be succeeded at Bridgeport by H. C. NEWELL of the U. S. Worsted Co.

DENT R. MCDOWELL, formerly with the B. F. Goodrich Rubber Co., has become head of the India Machine & Rubber Mold Co.

CHARLES W. MOON, for six years employment manager of the Timken Roller Bearing Co., will become connected with the sales force of the Canton Bridge Co. Mr. Moon has already assumed his duties. Before becoming associated with the Timken company he was employment manager for the R. K. LeBlond Machine Tool Co., Cincinnati.

GEORGE W. YEOMAN, vice-president of the Continental Motors Corporation, Detroit, has resigned.

RALPH C. CHESTNUTT, formerly chief engineer of the Templar Motors Corporation, has become truck engineer of the White Motor Co., Cleveland

W. D. APPEL, formerly assistant chief engineer of the Olds Motor Car Co., has been made a member of the technical staff of the General Motors Export Co.

C. E. WILSON, formerly assistant manager of the Remy division of the General Motors Corporation, has been made manager, succeeding I. J. Reuter.

HELEN E LEWIS of 14 Hillside Ave., Naugatuck, Conn., is engaged in the manufacture of valve tools and other mechanics' tools under the trade name of the American Valve Tool & Manufacturing Co.

HERBERT W. WOLFF. resident vice-president in Chicago and G. R. SCANLAND, formerly auditor, have been elected directors of the American Car & Foundry Co.

J. H. MARKS, formerly industrial engineer of the Packard Motor Car Co., has been appointed purchasing manager of the company.

W. M. CORSE, formerly with the National Research Council, is now with Research Service, Investment Building, Washington, D. C.

FRANK BEMENT and EDWARD A. DEEDS were elected directors of the Niles-Bement-Pond Co., New York, to fill vacancies.

FREDERICK M. HOLMES of the North & Judd Manufacturing Co., New Britain, Conn., has returned from a business trip to the Pacific Coast. He reports the business outlook as favorable.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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MOST market observers agree that the speculative vapors which have been obscuring the course of the nation's business are passing. The grain markets have been thoroughly shaken out by severe declines and many of the foolhardy persons who tried to get rick quick by trading in them have been permanently removed from the scene by the loss of their capital. Doubtless there will be a recovery and a secondary bull movement, but such advances are rarely impressive.

The stock market has apparently entered the "selling area." It is highly irregular. Despite the success some of the pools are still having with their proteges a decreasing disposition to pay the ruling prices for the standard industrials and rails is becoming evident and the general list shows a tendency to sag. It is only a step from this point to extensive profit taking and distribution, during which the peak will be reached.

Meanwhile it is to be observed that the subsidence of the speculative fever in these markets is chilling commodity prices in general. In Chicago livestock and hides, both of which are statistically strong, have been dull and easy. Lard sold last week at the lowest of the year to date. The decline in wool is unchecked. The Brazilian coffee shippers are making lower offers. Sugar and rubber are just about holding their own.

And what is disclosed when the speculative glamour is dissipated and industry and trade are examined directly? First that production in the most basic industries has increased. The iron and steel mills are working virtually at capacity and have enough orders to keep them fully occupied for the next month or so. What will happen thereafter is problematical. The industry is notoriously prince or pauper. Buying for today is completed and much of the buying for tomorrow is also done. Hence some of the snap is out of the markets and the mills will not be able to sustain their great activity unless there is a greater expansion in building and in the manufacture of machinery, automobiles and railway equipment than the purchases now made have allowed for.

While the fluctuations are severe in steel and the other industries located at the beginning of the highway leading from production to consumption they are scarcely apparent at the end of the road, where retail selling completes the chain. January sales of department stores as compiled by the Federal Reserve Board were only one-tenth of one per cent greater than in January, 1924; in seven of the twelve districts they declined and only the St. Louis and Minneapolis districts recorded pronounced advances. As prices are higher final distribution of goods throughout the country was obviously smaller instead of larger.

This is not surprising, for the farmer is the only one whose consuming power has really been increased by the price advances and reports from the West throughout the winter have indicated that he was a canny buyer. It is nevertheless not discouraging, since if seasonal expansion is allowed for, retail trade seldom varies as much as most people think and comparative stability is its normal state.

Between the broad fluctuations at the beginning of the business line and the stability at the end a variety of conditions exist, differing as they are nearer one or the other. Some of the secondary manufacturing industries have already felt the stimulus and others will be still improving when steel is receding. The secondary distributive trades are quieter in proportion as they are nearer the retailer. They feel the impetus of primary recovery less and they will be less affected when the basic industries begin to decline.

The theory of relativity, as formulated by Einstein, and the doctrine of mental health, as put forward by the newer psychologists, should not be ignored by the business world. For there is a psychological relativity in industry that is of great importance.

The majority of business men are still waiting for the long heralded business improvement. Some actually expect a boom; some feel that they are doomed to wait for a period of undefined duration. It is possible that both are wrong.

If business as a whole has not reached expectations, the fault would seem to lie with the expectations, rather than with business itself. Many of the indicators point to the fact that we are even now enjoying reasonable prosperity. The volume of checks cashed as reported to the Federal Reserve Board weekly, has for a number of weeks been running heavily above that of a year ago, and these increases have by no means been confined to the stock speculative centers of the East. The same is true of car loadings. Imports and exports are heavy and money rates have not advanced despite the continued export of gold. Industrial and railroad profits, with a few notable exceptions, are satisfactory.

As for the expectation of a "boom," meaning that every factory wheel will whirl at top speed and everything made will be easily salable, that ought to be abandoned. Until foreign markets can take our merchandise in far greater quantities than they can today; or until our will-to-consume at home largely increases our standard of living, our nation will sell less than it could produce if it operated at maximum capacity.

What's Doing in Industry

Business proved to be a little better in the machinery and machine tool lines last week and prospects for future improvement are still brighter. Inquiries were received to a greater extent than previously, while there was a noticeable betterment in railroad buying in the East and automotive buying in the Midwest. Production is reported as improved in the Cincinnati and the New England districts.

Some encouraging features were noted during the week. Statements that automotive production would be greater than last year and almost equal to that of 1923 were made by authorities in Detroit. Railroads have been buying more equipment during the past two weeks than for some time, which will mean the car builders will eventually buy machine tools. The roads are also preparing lists for repair shop expansion and replacement and last week some tools were bought against these lists. Agricultural implement makers are busy with orders and will be for some months. The steel mills are working at better than 85 per cent of capacity with the United States Steel Corporation reported at nearly 95 per cent. Exporting is better than it has been since the war and further improvement is anticipated within the near future. There are practically no labor troubles on the horizon and the finances of machine tool buyers are sound. The analysis of the future is certainly most optimistic.

A report that caused more than ordinary interest this week was to the effect that Italy was proving to be an excellent machine tool customer.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Cleveland

The first half of February has not brought the unusual into the machine tool market in the Cleveland district. Expectations of leading producers that there would be a significant turn for the better, so far have not been realized, though this would seem to be well founded in view of the development of inquiries since the beginning of the year. In some instances also this belief is borne out by the fact that some equipment is actually being booked.

At the same time many manufacturers who have persisted in consistent business-building activity, have, for the moment, suspended operations in that direction, feeling that the time is not yet ripe for broadsides of this character.

During the last week the best developments have come in the lathe, planer and allied fields. This demand is even more widely scattered than it was a few months ago. A demand for new equipment is coming from railroads, that hitherto have held back in final placings. Industrial establishments that are rebuilding their own operating plants are also buying.

Orders for automatic machines and similar equipment have slowed down.

Though the beginning of the active building season is not far distant, there has not been the response for heavy equipment that is required in structural steel and similar manufacture.

Cincinnati

Conditions are improving in the local machine tool market. Manufacturers state that both inquiries and sales have been better since Feb. 1 than during January. An improvement is shown by the majority of plants as compared with the same period a year ago. There are a number of companies that report only limited production, but the Cincinnati market, considered as a whole, is gradually increasing its output.

Railroads and automobile manufacturers have not been in the market for any large purchases lately. There are, however, several roads having lists out that they expect to close shortly. Most of the business now being booked is coming from other industries than railroads and automobiles. An encouraging sign at present is the improvement in the export trade. Several sizeable orders have been placed recently with Cincinnati machine tool houses by foreign concerns.

Lathes and milling machines have been in fair demand. Several good orders for them have been received in the past ten days. Two sales of planers were closed during the last week. Radial and upright drills have been commanding a fairly good market, although sales have been somewhat spotty. Electrical tool manufacturers state that their business has been fair. They believe that their production will be good during the next month. Gear manufacturers report that they have maintained steady operations in February and that the volume of their output this month will probably be about on a par with that of a year ago.

The used machinery market is in good condition with sales for February ahead of those for January. Comparison with 1924 figures shows that there are more used machines and tools being sold now than during the corresponding period last year. Foundries are running on a reduced schedule, but are operating a little better than in January. The Chevrolet plant at Norwood is reported to be operating on a normal basis.

New York

More sales were noted in the machinery and machine tool markets of New York during the past week and the number of inquiries also increased considerably which improved the general outlook of the business to quite an extent. Railroads that had been out of the market for some time proved to be the best purchasers during the past week with the New York Central, the Baltimore & Ohio, the Pennsylvania and the Missouri Pacific mentioned as buyers. Locomotive and car builders were also in the market for single tool orders.

The General Electric Co. was in the market with both inquiries and purchases, but the other big electrical companies did not show interest. The General Electric Co. is making radio parts and there have been big increases in this branch of its business.

Exporters report a lively market abroad and machine tools are in demand in most European countries. One exporter reported January to be the best month he has had since the War, while others state that the season is unusually busy.

Detroit

The machine tool and machinery industry is apparently on the threshold of increased activity in the Detroit district. Predictions that business will soon take the upgrade have been made so freely since the first of the year and have failed to materialize to the extent predicted, that many leaders are growing rather wary of the immediate prospects.

Inquiries are many, and presage better business for machine tool dealers. The slow rise in production figures in the automobile plants and the steady, although rather slow, increase in the employment figures have eliminated the pessimistic outlook that many had a few weeks ago, but that local conditions are behind what had been hoped for is not denied by local dealers.

Stronger competition between the leaders in the automotive field is already having its imprint as the larger motor car plants are preparing for bigger production schedules than last year.

Orders for special machinery along assembly lines that will eliminate some of the antiquated equipment now in use are being slowly placed by automobile manufacturers.

Milwaukee

While the majority report from the metalworking machinery trade concludes that the market is still slow and inclined to be sluggish, the rate at which inquiry is coming is accepted as a most encouraging sign of the more active business that seems to be ahead. Not the least of the hopeful signs is that the foundry and machine shops in this market are adding more men almost every day, being in a position where contracts and fresh orders for prompt and nearby delivery require the enlargement of the production schedules. These, however, have not yet reached the same level of this period in 1924.

Manufacturers of milling machines, who have been experiencing a lengthy period of dull demand, are now developing better business, especially in the new designs that have been evolved in order to meet the necessities of the day, that are inclined to go beyond the standard types of former days to effect saving in man-power and make a single tool serve a greater number of purposes. Such requirements are coming both from the smaller custom shops as well as the larger volume producers.

In the automobile industry, demand for metalworking equipment is spotty, but in all amounts to a larger volume than the trade has known in at least five to seven months. The total is brought up by the volume purchases of a few individual makers, however. A feature that is developing rapidly is the call for tools from the motor truck industry, especially the manufacturers of motors, transmissions and axles. The growth of the bus industry is contributing materially to the activity in the heavy-duty vehicle trade, although the sale of freight transportation vehicles is also increasing. The demand for 3½- to 6-ton capacity trucks was relatively slow for two years, while ¾- to 1½-ton cars were in relatively good request, but the unbalance is now being overcome, and the prospects for steady improvement in general business make the producers of the heavy freight trucks feel that they are due for a much broader market.

Although the sale of machine tools of various classes to the agricultural

equipment industry has not made any marked strides, nevertheless the scale of operations of such plants is constantly being expanded to meet the immediate and prospective demand growing out of the better feeling in agriculture due to the substantially enhanced value of farm products.

Philadelphia

Business in most industrial lines continued spotty throughout the industrial centers of Philadelphia last week. Manufacturers who foresaw the outcome of national events early last fall and bought raw material in the hope of seeing a revival of business, are now looking ahead to a much more prosperous year than those who failed to take advantage of the situation prevailing at that time.

There has been an uninterrupted advance in the price of iron, copper, zinc, steel and other basic commodities since last November. This has caused a loss of confidence to some business men who earlier had anticipated a substantial increase in their business and has resulted in some large manufacturers paring down their estimates for the year.

Machine tool manufacturers this week saw little change from the situation prevailing last week, when heads of some of the larger firms pointed to a favorable basic economic situation as foretelling an eventual rise in the volume of business.

Some of the smaller dealers say there is some business being transacted in used machinery, while repair men find a rather steady volume of business. Machinists specializing in designing have found a rather brisk increase in business coming mostly from the automobile industry, but its extent does not appear to be sufficiently great to warrant a forecast of a steady upkeep.

Indianapolis

Production of machinery and machine tools is increasing in Indiana. In some quarters the situation is far more favorable than it has been for months and naturally the executives of these plants are highly optimistic. Even those who have not been so fortunate in orders are far from pessimistic. With mounting prices of hardwoods, the mills in Indiana are replacing considerable obsolete machinery that has been carried through the era of rather low prices. Dealers in road building machinery are especially optimistic.

Advance information from the state highway commission indicates that the volume of state road construction will be greater this year than last and already many of the larger counties of the state are advertising contracts in large numbers.

The railroad, utility and automobile requirements for tools have been a little off during the last two weeks, but in the case of the first two industries, the weather has been bad and business is dull in the automobile business. The latter is expected to improve, however, now that executives are back from the mid-winter shows. One of the biggest prospects for the machinery trade this spring appears to come from the furniture factories. Already a number of inquiries has come from this source and it is reported authentically that the volume of business done at Grand Rapids and Chicago by local factories exceeds all previous records.

Business is dull in the shear and punch field, Indiana fabricating plants being cautious in their purchases.

Dealers in used machinery report the situation decidedly spotted, but a considerable volume of inquiries leads to the belief that the February volume will be good.

Chicago

No marked changes have characterized the Chicago machine tool industry during the last week. Dealers are experiencing a period of comparative inactivity, but it is generally felt that this is only temporary and that the market will react promptly to the nation-wide increase in production of all commodities that is believed to be almost due.

Chicago bankers, who have opportunities for feeling the business pulse, are decidedly optimistic in their views. In a recent survey by one of the biggest banking institutions of this city it is stated that there is a sound basis for optimism, and that the feeling of confidence that prevails is justified. One of the things pointed to as contributing to this is the great improvement in agriculture. Another is noted in the increased manufacturing output, which, while not having reached boom proportions, is satisfactory as a whole.

C. W. Nash, president of the Nash Motors Co., commenting on the recent enlargement of the company's plants and the large quantity of new equipment it has been necesary to buy, referred to the fact that 254,236 sq.ft. of floor space had been added, and $1,500,000 expended for plant equipment, making it possible to increase production by 40 per cent.

Another indication of renewed industrial activity is found in the railroad situation, that is constantly improving. This week the Chicago Rock Island & Pacific Railway Co. asked for bids on 1,200 box cars and 400 coal cars, and has placed orders for 45,000 tons of rails.

Southern District

A general improvement in the demand for nearly all machinery and tool lines is reported by the Atlanta dealers the first week of February, with inquiries giving promise that this will prove a very good month, equally as good as February, 1924, when an unusually heavy volume of business was enjoyed.

Most industries in the district are operating on an active basis and, with ample orders in hand to insure steady production for some months, they are buying much more freely of equipment than they have in several months.

Lumber plants and the furniture industries are enjoying the best sales in the past three or four years, particularly the latter, and machinery sales to this source have been very good since the middle of January, especially sales to new plants that are being constructed in the Southeast. Many of these sales are of used or rebuilt equipment, but there is also a good business reported in new woodworking machinery.

The textile industries are becoming more active from week to week, and although sales to this source are still below normal, inquiries indicate that improvement is in early prospect. The first half of the year should prove a good period in sales to textile mills, according to present indications. A number of new mills are now under construction in Georgia, Alabama, Tennessee and the Carolinas entailing a total investment of several million dollars.

The railroads are still the most active buyers, particularly of heavier equipment, and better inquiries from this source are reported. While most of the development work at present appears to be in the laying of new trackage or repairing of present roadbeds, considerable shop and terminal construction also is being carried out in all parts of the South, or is planned for the next few months by the principal railroads operating in this section. Railroad equipment sales are expected to be equally as good as last year, when a new record in this regard was established by Southern dealers.

Buying of road building machinery and equipment also is reported from practically all the Southern states, and this business also bids fair to equal that of last year.

Financially the district is in good condition, primarily because staple cotton prices have now been maintained for several months.

New England

The machine building industry and allied trades showed improvement during the past week. Sales have been greater, inquiries were more numerous and the tone of the inquiries indicated a trend toward a rehabilitation of business.

Machinery sales were better and embraced representative orders for a wide range of automatics and smaller machinery. The buying was from the railroads and automotive industries, and was from various sections of the United States. Automatic machinery buying for New England industries was large and was judged to be for replacements.

The special machinery builders reported improvement in orders, many of them being for export shipment.

Manufacturers of chucks and dies in Hartford and New Britain report a very encouraging amount of business, especially for foreign deliveries. England and France are both buying.

Hartford corporations are preparing to add to their production schedules so that they may keep up with business already booked. Overtime operations may be necessary. Manufacturers reiterated previously expressed determination to manufacture close to the demands for immediate deliveries, hoping thereby to keep employment on an even plane throughout the year.

In Bridgeport plant expansions are being planned, work to begin as soon as weather permits.

Business Items

The E. L. Essley Machinery Co., Chicago, has completed negotiations with the Nazel Engineering & Machine Works, Philadelphia, for the exclusive sale of that company's air hammer.

The Husky Wrench Co., 928 16th Ave., Milwaukee, Wis., has increased its capital stock from $50,000 to $90,000, and is adding a new line of large industrial socket wrenches to its standard line of interchangeable socket wrenches for automotive maintenance work.

The Terre Haute Grinding & Machine Co. has moved into its new home at 1000 Poplar St., Terre Haute, Ind. The new building is 50 ft. wide and 140 ft. long, of concrete block, with a faced brick front.

The Newton Machine Tool Works of the Consolidated Machine Tool Corporation of America has been moved from Philadelphia to Rochester, the general headquarters of the company. Three of the five divisions of the company are now located in Rochester.

The Boston office of the Joseph Dixon Crucible Co., Jersey City, N. J., has been moved from 49 Federal St. to 80 Federal St.

The James Clark, Jr., Co., Louisville, Ky., has been appointed a distributing jobber of the General Electric Co.

The Midwest Forging Co., Chicago, is enlarging its works at Chicago Heights by adding a steel building to be used for manufacturing purposes, and a steel building for steel storage with crane service.

The Superior Nonferrous Foundry Co. of South Bend, Ind., has been incorporated to conduct a general foundry business. The incorporators are Clarence C. Walters, Hope P. Walters and Anna I. E. Walters, all of 601 East Dayton St., South Bend, Ind.

The Faith Machinery Co., 2533-39 N. Ashland Ave., Chicago, has been incorporated to manufacture and deal in castings, implements, tools, fixtures, machinery, dies and automobile accessories. The capital is $100,000.

The following new incorporations have been granted charters by the Illinois Secretary of State: the M. C. M. Co. 175 N. Michigan Ave., Chicago, to install, manufacture and equip machinery and equipment; the Victory Tool & Supply Co., 550 W. Washington St., Chicago, to deal in tools, hardware and machinery; J. R. Burrell & Co., Marseilles, Ill., to manufacture and sell machinery.

The Hudson Motor Car Co. is negotiating the purchase of the stamping plants of the Clayton & Lambert Manufacturing Co., a Detroit concern that supplies the Hudson company with stampings and other accessories.

The Indianapolis Pump & Tube Co. has moved its offices from Greenwood, Ind., to the National City Bank Building Indianapolis. The company will have only its factory offices at Greenwood, operating principally from its Indianapolis offices.

Negotiations are practically completed for the purchase by the Motor Products Co., of the Parsons Manufacturing Co., of Detroit, manufacturer of automobile hardware, tools, dies, etc. according to the *Wall Street Journal*. The Parsons company was organized in 1914 with initial authorized capital of $15,000 that has since been increased to $300,000 according to latest available financial statement (September, 1922) of which over $200,000 is understood to be paid. Company has plant and equipment investment of $350,000.

The McCord Spring Wheel Co. of Milwaukee has been incorporated in Wisconsin with $400,000 authorized capital by J. B. Reik, J. C. McFadden and Fred V. Janssen, all of Milwaukee. It is a reorganization for the purpose of transferring the business of a corporation of similar name now operating assembling plants in Chicago and Muskegon, Mich., to Milwaukee, where it is proposed to build a foundry and machine shop. Besides spring wheels for commercial vehicles, the new organization proposes to manufacture a number of other automobile and motor truck specialties.

Officials of the Crankless Engine Co., Jacksonville, Fla., have announced that this company will discontinue the manufacture of the crankless Diesel marine engine, through an arrangement with the Morse Dry Dock & Repair Co., of New York City, whereby the latter concern will take over the production of the Diesel engine. The Jacksonville concern, however, plans to continue the manufacture of automobile engines as heretofore.

Obituaries

HUGH J. ARMSTRONG, president of the Armstrong Bros. Tool Co., Chicago, died recently in that city.

EDWIN NELSON WALKLEY, treasurer of the firm of Peck, Stow & Wilcox, Southington, Conn., manufacturers of tools and hardware, died Feb. 4, aged 64 years. Ha was a graduate of Massachusetts Institute of Technology.

WILLIAM EVERETT QUIMBY, founder and president of the Quimby Pump Co., Newark, N. J., died recently at St. Luke's Hospital, New York City.

E. J. ARMSTRONG, a director of the Erie Steam Shovel Co., Erie, Pa., died recently in Savannah, Ga.

Warning Against Bad-Check Passer

Dealers in the Eastern part of the country are warned against a party who is working a check cashing scheme on machine tool dealers in Boston, and New York City. The method of passing these spurious checks is to contract for the purchase of a tool and then to give a check for an amount greater than the deposit required.

Pratt Institute Will Hold Reception

Thursday evening, March 5, from 7:30 to 9:30 o'clock, will be "Visitors' Night" in the School of Science and Technology of Pratt Institute, Brooklyn. The extensive laboratories, shops and drawing rooms of the school will be open to the public, affording an opportunity to all persons interested to observe the many improvements. There will be no other public exhibition this year of the School of Science and Technology.

The School of Science and Technology gives technical instruction of great practical value to men employed in industry and engineering. This season's courses include some forty classes in mathematics, physics, electricity, chemistry, mechanical drawing, machine design, strength of materials, structural design, stationary steam engineering, automotive engine maintenance and othes subjects.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Bolts and nuts, hexagonal, round head rivets, and wire nails. Alexandria, Egypt. Purchase and agency. Reference No. 13,629.

Lathes, drill presses and machine tools. Bordeaux, France. Exclusive Agency. Reference No. 13,634.

Grinding plates, segments, wheels and machinery. Dresden, Germany. Purchase. Reference No. 13,563.

Machine tools. Sydney, Australia. Agency. Reference No. 13,558.

Machine tools. Budapest, Hungary. Agency. Reference No. 13,638.

Diesel motors, three to fifty hp. Lyon, France. Purchase. Reference No. 13,553.

Woodworking machinery. Sydney Australia. Agency. Reference No. 13,558.

Forthcoming Meetings

Southern Supply & Machinery Dealers' Association and the American Supply & Machinery Manufacturers Association. Joint Convention. The Atlanta-Biltmore Hotel, Atlanta, Ga., May 5, 6 and 7. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

The Society of Industrial Engineers. National Convention. Hotel Winton, Cleveland, Ohio, May 6, 7 and 8. Executive secretary, George C. Dent, 608 S. Dearborn St., Chicago, Ill.

American Gear Manufacturers' Association. Ninth annual convention, May 6, 7, 8 and 9. The William Penn Hotel, Pittsburgh, Pa. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

American Society of Mechanical Engineers. Spring Meeting. Milwaukee, Wis. May 18, 19, 20 and 21. Calvin W. Rice, secretary, 29 West 39th St., New York City.

Society of Automotive Engineers. Summer Meeting. Greenbrier Hotel, White Sulphur Springs, W. Va., June 16, 17, 18 and 19 C. F. Clarkson, secretary, 29 West 39th St., New York City.

American Society for Testing Materials. Twenty-eighth annual meeting. Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 22, 23, 24, 25 and 26. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

National Foreign Trade Council. Annual Convention. Seattle, Wash., June 24, 25 and 26. O. K. Davis, secretary, India House, Hanover Square, New York City.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Iron buying quiet; prices about 50c. per ton below minimum of a week ago. Current steel demand is running largely to pipe, galvanized sheets, railway materials and bars. Unfilled orders on books of the U. S. Steel Corp., Jan. 31, 1925, amounted to 5,037,323 tons, the heaviest since Aug. 31, 1923, at which time the total was 5,414,663 tons. The price of steel structurals, on the date last mentioned was $2.50 per 100 lb. at Pittsburgh mill; present quotations are $2@$2.20 per 100 lb. With every increase in demand the price will approach nearer to the August, 1923, level. The fact that buying is not only for current needs but also for replenishment of stocks, would indicate little danger of the $2.50 level being reached.

Non-ferrous Metals—Tin and antimony are advancing sharply; other metals firm at present levels.

Other Materials—Declines reported in linseed oil, wiping cloths and transmission belting.

(All prices as of Feb. 13)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.05
Northern Basic	23.77
Southern Ohio No. 2	23.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2. 25@2. 75)	30. 25
BIRMINGHAM	
No. 2 Foundry	21.00@22.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2. 25@2. 75)	24.76
Virginia No. 2	30.17
Basic	24.76
Grey Forge	23.75
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern (silicon 2. 25@2. 75)	25.55
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	23.77
Basic	23.77
Bessemer	23.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.70@2.80	3.89	3.45	3.80
No. 12	2 80@2.90	3.94	3.50	3.85
No. 14	2.90@3.00	3.99	3.55	3.95
No. 16	3.10@3.20	4.09	3.65	4.15
Black				
Nos. 17 and 21	3.45@3.55	4.55	4.15	4.30
Nos. 22 and 24	3.50@3.60	4.60	4.20	4 35
Nos. 25 and 26	3.55@3.65	4.65	4.25	4.40
No. 28	3.60@3.70	4.75	4.35	4.50
Galvanized				
Nos 10 and 11	3.75@3.80	4.75	...	4.50
Nos. 12 and 14	3.85@3.90	4.85	....	4.60
Nos. 16	4.00@4 05	5.00	....	....
Nos. 17 and 21	4.15@4.20	5.15	....	4.90
Nos. 22 and 24	4.30@4.35	5.30	3.00	5.05
No. 26	4.45@4.50	5.45	4.15	5.20
No. 28	4.75@4.80	5.75	5.45	5.50

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	59½%	48%
3½ to 6 in. steel lap welded	48%	35%	53½%	40½%	56½%	45%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 36% off.

Size, Inches	List Price per Foot	Diameters Inches — External	Diameters Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ½-in. to 1-in., O.D., weighing 0.17 lb. to 0. 36 lb. per ft. Cutting charge per 100 cuts, $1. 50 to $1. 58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
½	$0. 09	50%	⅛	$0. 16	35%
⅝	. 11	45%	1	. 18	31%
¾	. 14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular . 10-. 20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4. 50	6. 00	4. 20
Spring steel (light) (base)	7. 00	6. 00	6. 00
Coppered Bessemer rods (base)	6. 85	8. 00	7. 20
Hoop steel	4. 49	4. 35	4. 15
Cold rolled strip steel	7. 00	8. 25	7. 85
Floor plates	5. 55	4. 60	5. 50
Cold drawn shafting or screw	4. 15	4. 00	3. 80
Cold drawn flats, squares	4. 65	4. 50	4. 30
Structural shapes (base)	3. 34	3. 20	3. 10
Soft steel bars (base)	3. 24	3. 10	3. 00
Soft steel bar shapes (base)	3. 24	3. 11	3. 00
Soft steel bands (base)	3. 99	3. 20	3. 65
Tank plates (base)	3. 34	3. 42½	3. 10
Bar iron (3 00@3. 10 at mill)	3. 24	3. 21	3. 00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to 1/4, 7.35c. per lb. Chicago, 3/32, 8.85c.; 5/32, 7¼c.; ⅛, 7.95c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York				15.25
Tin, 5-ton lots, New York				58.50
Lead (up to carlots), St. Louis	9.25@9.35	New York	..	10.25
Zinc (up to carlots), St. Louis.	7.40	New York	..	8.50

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	22.00	20.00	16.25
Copper sheets, base	23.00	23.25	22. 12½
Copper wire, base	20. 62½	21. 87½	20.75
Copper bars, base	22. 25	23. 75	22. 62½
Copper tubing, base	25.25	25. 87½	25. 75
Brass sheets, base	19. 62½	20. 25	19. 25
Brass tubing, base	24. 25	26. 00	25. 00
Brass rods, base	17. 62½	19. 37½	18. 37½
Brass wire, base	20. 12½	21. 25	20. 25

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	27.20	28.00	27.00
Zinc sheets (casks)	12.00	12.25	11.37
Solder (½ and ½), (case lots)	42.00	37.50	.....
Babbitt metal (83% tin)	60.00	68.50	50.00
Babbitt metal (35% tin)	28.00	21.50	28.00
Nickel (ingots) f.o.b. refinery	29.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	33.00	.....	.....
Nickel (F shot) f.o.b. refinery	30.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Rolled nickel sheet (base)	52.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.50@12.75	12.75	12.00
Copper, heavy, and wire	12.25@12.50	12.50	11.50@11.75
Copper, light, and bottoms	10.75@11.00	11.00	10 50
Heavy lead	7.75@ 8.00	8.00	8 00
Tea lead	6.75@ 7.00	6.50	6.75
Brass, heavy, yellow	7.75@ 8.00	8.00	8.00@8.25
Brass, heavy, red	9.75@10.00	10.00	9.75
Brass, light	6.75@ 7.00	7.00	6.75
No. 1 yellow rod turnings	8.25@ 8.50	8.00	8.00
Zinc	4.50@ 4.75	4.00	5.00

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23.50	$22.85	$21.00
"A" Grade:				
IC,	20x28, 112 sheets	19.00	18.80	17 00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	13.00	13.50	13.00
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.80@6.90	6.75

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.14@0.16
Cotton waste, colored, per lb.	.10@ .15½	.18	.09½@.12¾
Wiping cloths, 13¼x13¼, per lb	9.50	36.00 per M	.11
Wiping cloths, 13¼x20¾, per lb.	....	50.00 per M	.11
Sal soda, per 100 lb. keg	2.25	2.25	2.25
Roll sulphur, per 100 lb. keg	3.60	3.25	3.75
Linseed oil, per gal., 5 bbl. lots	1.24	1.33	1.25
Lard cutting oil, 25% lard, per gal.	.60	.50	.32
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	.35	.21
Belting—Present discounts from list in fair quantities (¼ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–2½%	30–10%	40–2½%
Heavy grade	30–5%	30%	38–5%
*Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50–5%	50–10%	60%
Second grade	50–10–2%	60–5%	65%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0354
Cold finished shafting	per lb.	.0415	.0415	.044
Brass rods	per lb	.1762½	.1737½	.15
Solder (½ and ½)	per lb.	.42	.42½@.43½	.3675
Cotton waste	per lb.	.15@.22	.15@.22	14@21
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	60	.60	.58
Machine oil	per gal.	.29	.29	.29
Belting, leather, medium	off list	40–2½%	40–2½%	40–2½%
Machine bolts up to 1x30 in.	off list	45%	45%	45%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$4.86	$5.84	.....
Emery paper	10.71	11.00	$11.90
Emery cloth	28.00	31.12	32.75
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.65
Cloth	3.38	2.67	3.55
Fire clay, per 100 lb. bag	.....	.65	.75
Coke, prompt furnace, Connellsville	per net ton		3.25@3.75
Coke, prompt foundry, Connellsville	per net ton		4.75@5.00
White lead, dry or in oil	100 lb. kegs	New York, 16.25	
Red lead, dry	100 lb. kegs	New York, 16.25	
Red lead, in oil	100 lb. kegs	New York, 17.75	

SHOP SUPPLIES

	New York	Cleveland	Chicago
Rivets: Button heads, ¾-in., ⅞-in., 1x2-in. to 5-in., per 100 lb.	$3.75	$3.50	$3.50
Cone heads, ditto	3.85	3.60	3.70
Washers, cast iron: ½-in. per 100 lb.	6.50*	4.00	3.75
⅝-in., per 100 lb.	5.50*	4.00	3.75

Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.50 per 100 lb. at Cleveland. Tap bolts with hex. heads are $4.65 per 100 lb. at Chicago.

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 45%; 1⅛ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 35%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 40%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 35%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 45%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35%.

Bolt ends, 1x12-in., 10c. per lb., less 45%.

Nuts, semi-finished, ½x½-in., 2c. each. Discount 70% for $\frac{5}{16}$-in. and smaller and 65% for ⅜-in. and larger.
Case hardened ½x½-in., 6c. each, less 50%.

Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 60%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ⅜-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Conn., Hartford—Buck & Sheldon, Inc., 60 Prospect St., Archts.—equipment for new garage on Market St.

Md., Baltimore — Standard Gas Equipment Corp., c/o Parker, Thomas & Rice, Archts., Union Trust Bldg.—equipment for the manufacture of gas ranges.

Mass., Boston—Chamberlain Garage, Inc., 8-16 Stoneholm St.—equipment and machinery for 5 story garage.

Mass., Fitchburg—A. W. Soari, 107 Mechanic St.—woodworking machinery, for manufacturing sash and doors.

Mass., Mattapan (Boston P. O.) — J. Brennan, 204 Delhi St.—lathe for universal use, metal and wood.

Mass., New Bedford—Continental Wood Screw Co., Pleasant St.—additional factory equipment.

Mass., South Boston (Boston P. O.)—D. Marr & Sons Co., 384 Dorchester Ave.—equipment for 2 story garage, including miscellaneous tools.

Mass., Worcester—A. S. Dogil, 80 Endicott St.—equipment and auto repair tools for garage on Gertrude Ave.

N. Y., East Aurora (East Ave. Station, Rochester, P. O.)—Daiger Toothaker Shops, Inc.—engine lathe with turret.

O., Columbus—Columbus Hardwood Mfg. Co., McKinley and Lorain Aves., J. W. Frey, Pres.—complete equipment for hardwood manufacturing plant, including 1, large saw; 2 planing machines, etc.

Pa., Pittsburgh—The Pittsburgh Transformer Co., Preble Ave., and Columbus St.—one, 15 ton crane; one, 50 ton crane; two, 2 ton cranes for new transformer manufacturing plant.

Pa., Pittsburgh—Pressed Steel Car Corp., Farmers Bank Bldg.—one, 10 ton electric overhead crane, 82 ft. span (used).

Wis., Milwaukee—Modern Grinder Mfg. Co., 64 Reed St., G. H. Ische, Sec., manufacturer of grinders—gear hobbing machine, automatic screw machine, lathes, drill presses, etc., to place fire loss.

Wis., Milwaukee — Seaman Body Corp., 1732 Richards St.—woodworking machinery for the manufacture of auto bodies.

Wis., Wauwatosa—Artone, Inc., 63 2nd St., O. J. Koch, Pur. Agt., manufacturer of advertising specialties—1 tinner's square shears, 1 brake.

Ont., Mildway—Geo. Schwalm & Sons—complete equipment for new planing mill and saw mill.

Ont., Tilbury—Citizens Lumber & Manufacturing Co., J. Foster, Mgr.—complete equipment for new plant for the manufacture of drop forgings. Total estimated cost $35,000.

Ont., Wiarton—T. J. Moore Woodworking Co.—complete equipment for the manufacture of bed frames and furniture parts, for woodworking plant.

Australia, Melbourne—Victorian Government Railways will receive bids until April 1, for furnishing one 15 ton electric traveling Goliath crane.

Opportunities for Future Business

Calif., Fresno — State Highway Comn., Forum Bldg., Sacramento, R. M. Morton, Engr., is having preliminary plans prepared for the construction of a 60 x 120 ft. maintenance and equipment plant, shop, etc., Olive St. and Southern Pacific R.R. tracks. Total estimated cost $50,000.

Calif., Los Angeles—Department of Public Service, Bureau of Light and Power, 207 South Broadway, is having plans prepared for the construction of a 3 story, 85 x 320 ft. machine shop on North Main St. Estimated cost $150,000. Eng. Dept. of Bureau in charge.

Calif., Los Angeles—C. W. Irwin, Westlake Professional Bldg., awarded contract for the construction of a 7 story, 80 x 175 ft. garage, on South Hope St. Estimated cost $360,000. Noted Nov. 27.

Calif., San Bernardino—State Highway Comn. Sacramento, will soon award contract for the construction of a maintenance shop, here.

Calif., San Francisco—American Meter Co., 1123 Harrison St., awarded contract for the construction of a 3 story, 120 x 120 ft. factory, at 11th and Bryant Sts. $165,350.

Calif., San Francisco — R. Crothers, Monadnock Bldg., plans the construction of a 2 story, mill and loft building on Mission St. near 14th St. Estimated cost $40,000. San Francisco Sash and Door Co., 189 Mission St., lessee. Architect not selected.

Every one of these items is reported by our authorized correspondents who are instructed to verify every item sent in. This free weekly service is published in the interests of the buyer and the seller, to bring them together and get machinery moving.

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BUSINESS NEWS DEPARTMENT
Tenth Ave. at 36th St., New York

Calif., San Francisco — Manufacturing Building Corp., 268 First St., awarded contract for the construction of a 4 story metal spinning shop, on Clementine St., near First St. $41,365.

Conn., Hartford—Buck & Sheldon, Inc., 60 Prospect St., Archts., are receiving bids until February 24, for the construction of a 4 story, 150 x 240 ft. garage, on Market St. Estimated cost $400,000. Owner's name withheld.

Conn., Waterbury — The Waterbury Fastener Co., Manhan St., awarded contract for the construction of a 1 story, 45 x 77 ft. addition to one of its buildings.

La., New Orleans—C. S. Williams, c/o Favrat & Livaudais, Hibernia Bank Bldg., Archts., awarded contract for the construction of a 5 story garage. $153,500.

Md., Baltimore—Masson's Express, 107 West Pratt St., has had plans completed for the construction of a 3 story, 90 x 170 ft. garage and warehouse, at Pratt and Poppleton Sts. Estimated cost $100,000. J. Freund, 1307 St. Paul St., Archt.

Md., Baltimore — Standard Gas Equipment Corp., c/o Parker, Thomas & Rice Union Trust Bldg., Archts., will receive bids until February 24, for the construction of a 1 story, 102 x 136 ft. factory, on Hamburger and Bayard Sts. Estimated cost $60,000.

Mass., Allston (Boston P. O.)—Seavey Realty Trust, c/o B. S. Brown, 65 Franklin St., Boston, Engr., plans the construction of a 2 story, 120 x 180 ft. garage, at 7-15 Scottfield Rd. Estimated cost $150,000.

Mass., Boston—Gilbert & Levine, c/o S. S. Eisenberg, 46 Cornhill, Archts., are receiving bids for the construction of a 2 story, 80 x 100 ft. repair and service garage on Vancouver St. and Huntington Ave. Estimated cost $100,000.

Mass., Boston—A. E. Orno, 161 Devonshire St., awarded contract for the construction of a 1 story, 115 x 200 ft. repair and service garage on Ipwich St. Estimated cost $100,000.

Mass., Boston—Payson Dana, Barristers Hall, awarded contract for the construction of a repair and service garage at 220 Devonshire St. Estimated cost $40,000.

Mass., East Boston (Boston P. O.)—B. Mullen, 27 Central Sq., awarded contract for the construction of a 1 story, 110 x 115 ft. repair and service garage, at Bennington and Saratoga Sts. Estimated cost $50,000. Noted December 25, 1924.

Mass., Lowell—Wesley M. Wilder Iron Co. plans to rebuild plant on Western Ave., recently destroyed by fire. Estimated cost $40,000. Architect not selected.

Mass., New Bedford—Continental Wood Screw Co., Pleasant St., will soon receive bids for the construction of a 2 story, 80 x 100 ft. factory, on Pleasant St. Estimated cost $75,000. Leary & Walker, Times Bldg., Archts.

Minn., St. Paul—Tri-State Telephone & Telegraph Co., 369 Cedar St., is having plans prepared for the construction of a 3 story, warehouse and garage, on 10th St. between Minnesota and Roberts Sts. Estimated cost $150,000. Mather & Fleishbein, 442 Endicott Bldg., Archts.

N. Y., New York — S. Solomon, c/o Gronenberg & Leuchtag, 450 Fourth Ave., Archts., is having plans prepared for the construction of a 2 story, 100 x 200 ft. garage, at 820 12th Ave. Estimated cost $300,000.

O., Cleveland—The May Co., N. L. Danby, V.Pres., Euclid Ave., awarded contract for the construction of a 3 story, 150 x 198 ft. garage at West 2nd St. and Lakeside Ave. Estimated cost $259,000. Noted January 29.

O., Euclid—Euclid Wood Products Co., L. H. Verbasky, Pres., 19422 Nottingham Rd. plans the construction of a 1 story factory addition. Estimated cost $40,000. Private plans.

Pa., McDonald—Pittsburgh File and Steel Co., is having plans prepared for the construction of a 1 story, 45 x 360 ft. factory. Estimated cost $10,000. Private plans.

Pa., McKees Rocks — Henderson Structural Units Co., awarded contract for the construction of a 1 story manufacturing plant. Estimated cost $40,000.

Wis., Milwaukee — Seaman Body Corp., 1732 Richards St., is receiving bids for the construction of a 5 story, 102 x 400 ft. factory, for the manufacture of automobile bodies. Private plans.

Ont., Mildmay — Geo. Schwalm & Sons plan to rebuild sawmill and planing mill, to replace fire loss. Estimated cost $30,000.

Ont., Niagara Falls—Oneida Community Co., Ltd., is having plans prepared for the enlargement of silverware manufacturing plant, here. Additional equipment will be installed. Estimated cost $100,000.

Ont., Toronto — Exide Batteries of Canada, 153 Dufferin St., is having plans prepared for the construction of a 2 story addition to plant. Estimated cost $35,000. William Steele & Sons, 31 Bloor St., East, Engrs.

Ont., York—Firstbrook Bros., 283 King St., East, Toronto, plan the construction of a factory, for the manufacture of wooden packing cases, on recently purchased site here. Estimated cost $200,000.